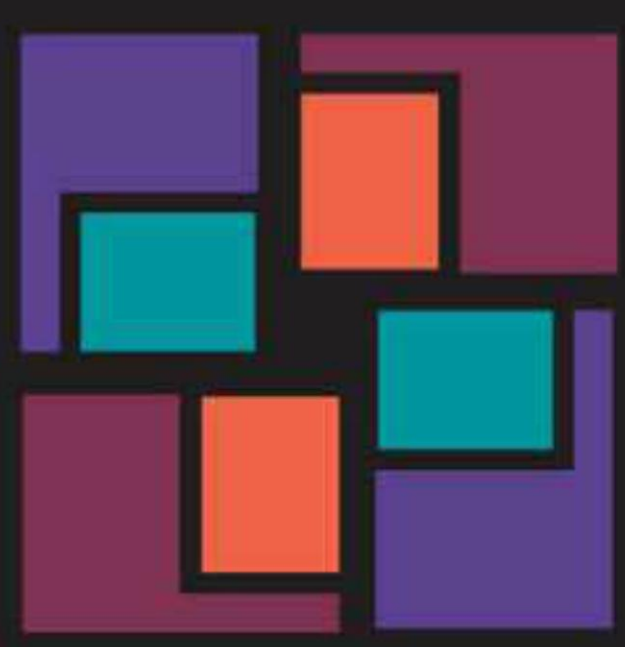
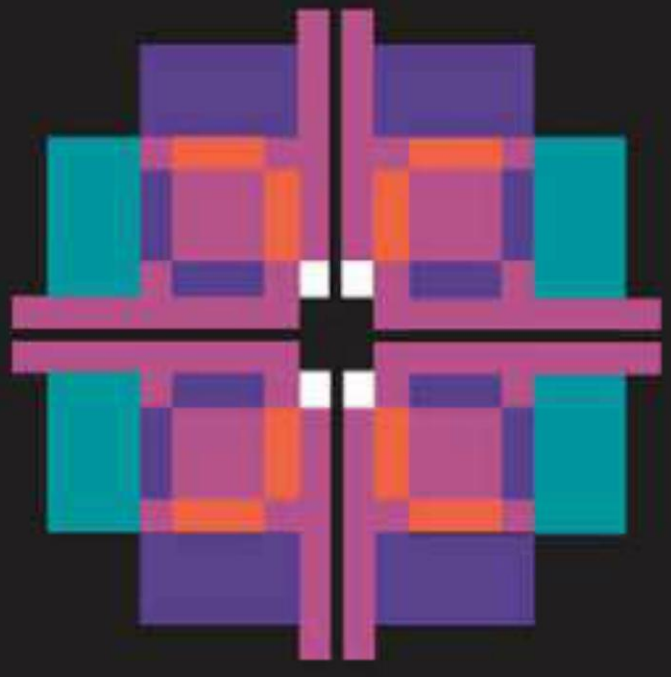
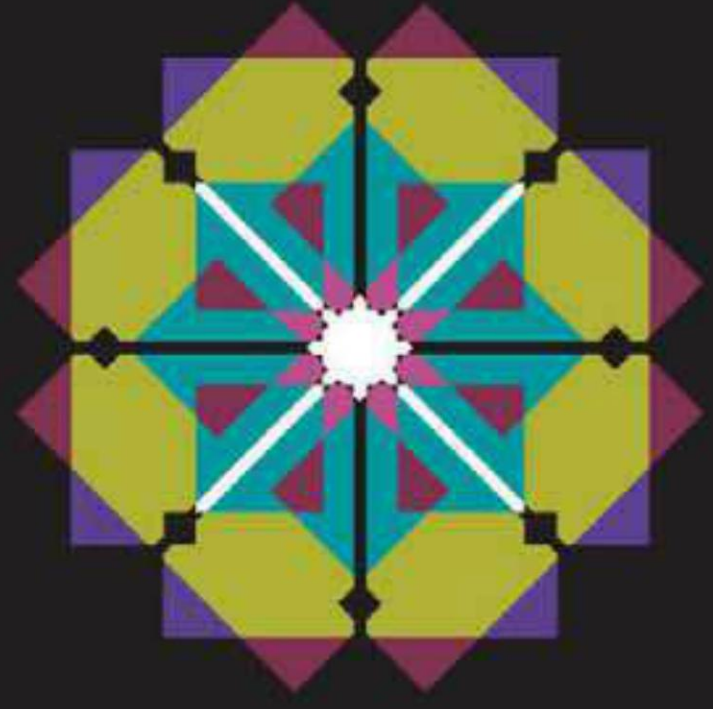
1001 SYMMETRICAL PATTERNS

A Complete Resource of Pattern Designs Created by Evolving Symmetrical Shapes







Jay Friedenberg and Jacob Roesch

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ROCK PORT PUBLISHERS
BEVERLY MASSACHUSETTS

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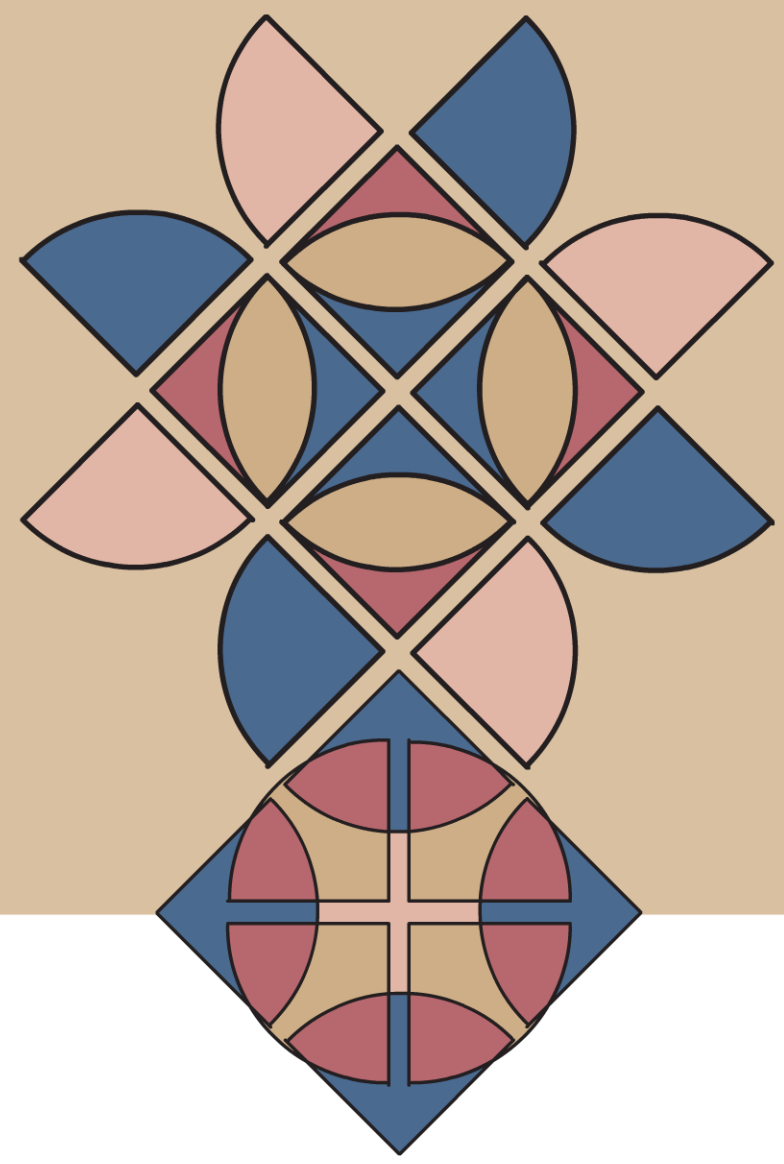

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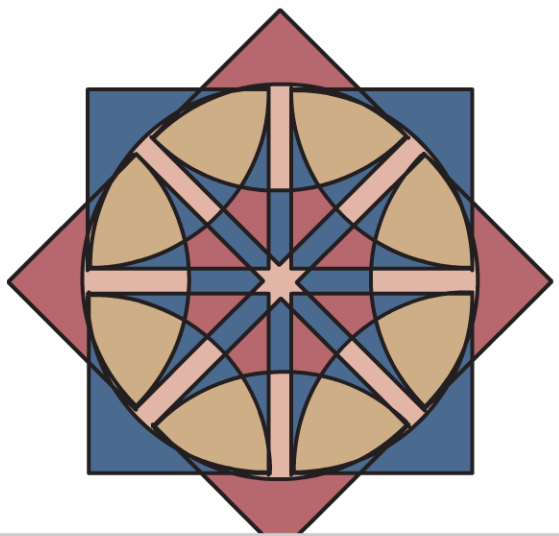
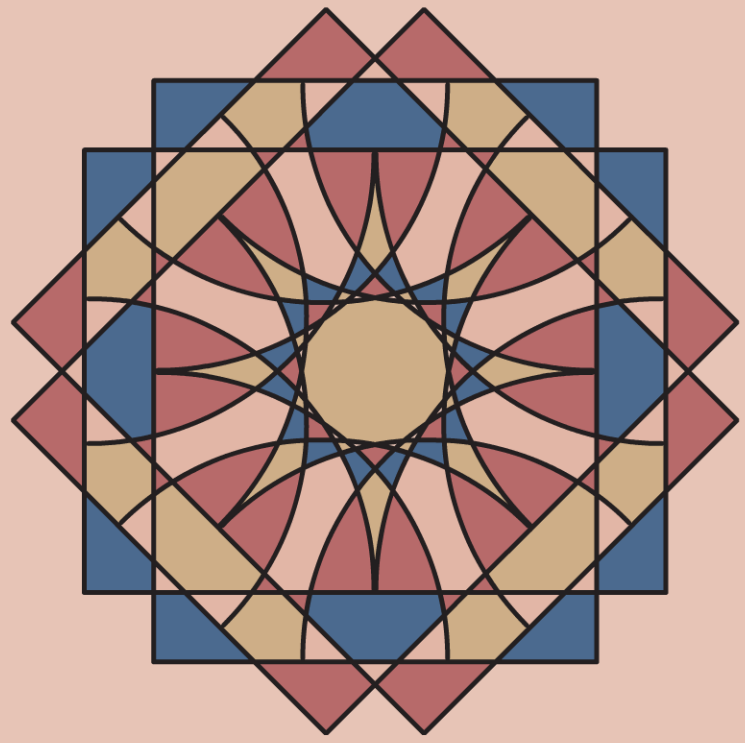
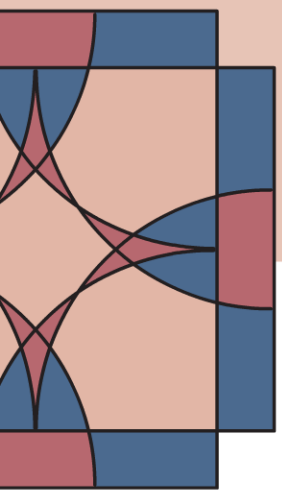


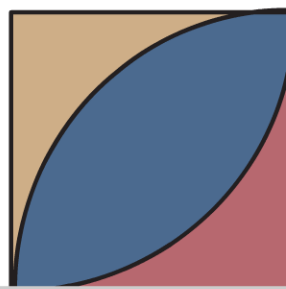
Introduction

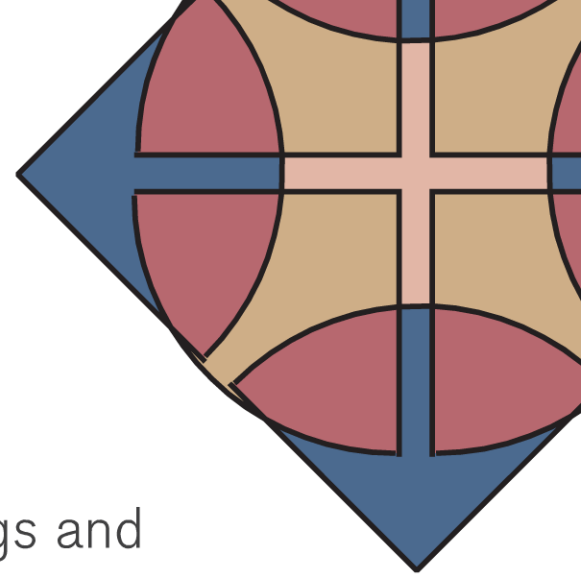




Visual symmetry in a broad sense refers to self-similarity. A pattern is symmetric if, after some operation, the pattern remains unchanged.[1] There are three primary symmetry operations.[2] A *translation* takes a pattern and simply moves it to a new location. We see the effect of translation in architecture, where columns repeat across the front of a building. In *reflection* a pattern is mirror-imaged or made bilateral with an axis defining the two opposite halves. Reflectional symmetry can be found in faces or bodies where one side corresponds to the other. Finally, there is *rotation*, where a pattern is spun about a point. Flower petals and wheel spokes are examples of rotational symmetry, since both are rotated about their centers.

Symmetry patterns are classified according to their dimensionality. A point or *finite symmetry* is a coherent single shape or object that is dimensionless because it is defined by its center. *One-dimensional symmetries* extend in a single direction only. Examples of these are decorative friezes or bands. There are a total of seven one-dimensional symmetry types. Each defined by the number and kind of symmetry operation applied. *Two-dimensional symmetries* extend outward in two directions and can





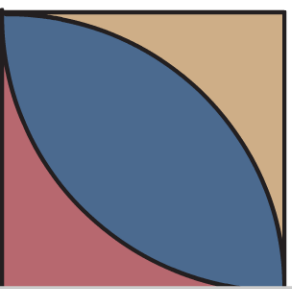
completely cover a planar surface. There are seventeen of these, again determined by the application of the number and kind of operation. Rugs and wallpaper are examples.

Symmetry is ubiquitous in the natural and artifactual world. Bilateral symmetry is found in biological organisms including most plants and animals, but we also see it in many human-constructed forms such as cars, airplanes, and furniture.[3] It appears in the art of all human cultures, including weaving, baskets, pottery, tapestries, textiles, embroidery, tiles, and jewelry.[4] Many of the plane symmetries can also be found as decorative art from around the world. All seventeen two-dimensional symmetry patterns have been found in the Alhambra.[5]

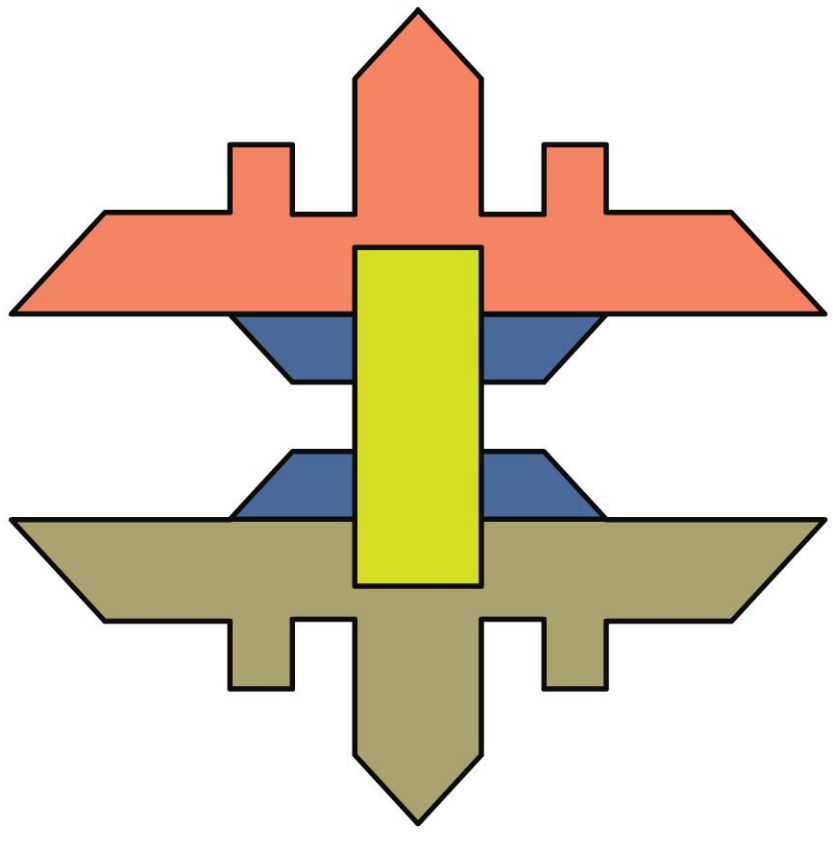
What is the enduring appeal of symmetry, and why does it seem to be regarded as universally aesthetic? There may be a biological basis. In psychology experiments, faces with greater reflectional symmetry are rated as more attractive.[6] Some researchers argue that bilateral facial symmetry signals resistance to parasitic infection because infections during development disrupt the body's normal symmetrical growth processes, and because sexual selection of an immunocompetent partner would thus help to ensure fit offspring.[7] However, this hypothesis cannot account for the allure of translational and rotational symmetries.

The patterns in this book are all finite-point symmetries forming single objects. The basis for each pattern is a motif that is translated, reflected, and rotated to create a new version of the motif that is then aligned with or superimposed upon itself. The motifs can be geometric, as in the case of squares, circles, and hexagons, or they can be representative of a shape such as a mushroom, ice cream cone, or kite. A number of the motifs we utilize here are inspired by existing designs from the history of decorative art and include Egyptian, Greek, Roman, Arabic, Indian, Japanese, Chinese, and Celtic as well as more modern computer-generated shapes.[8]

For footnotes, see page 206.



Airplanes



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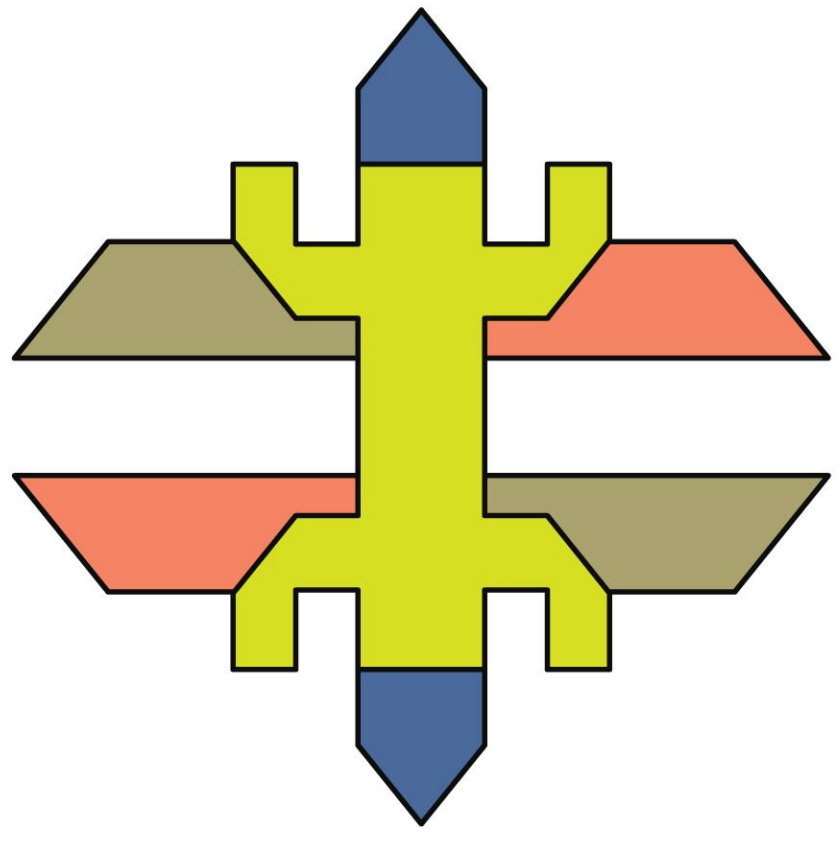

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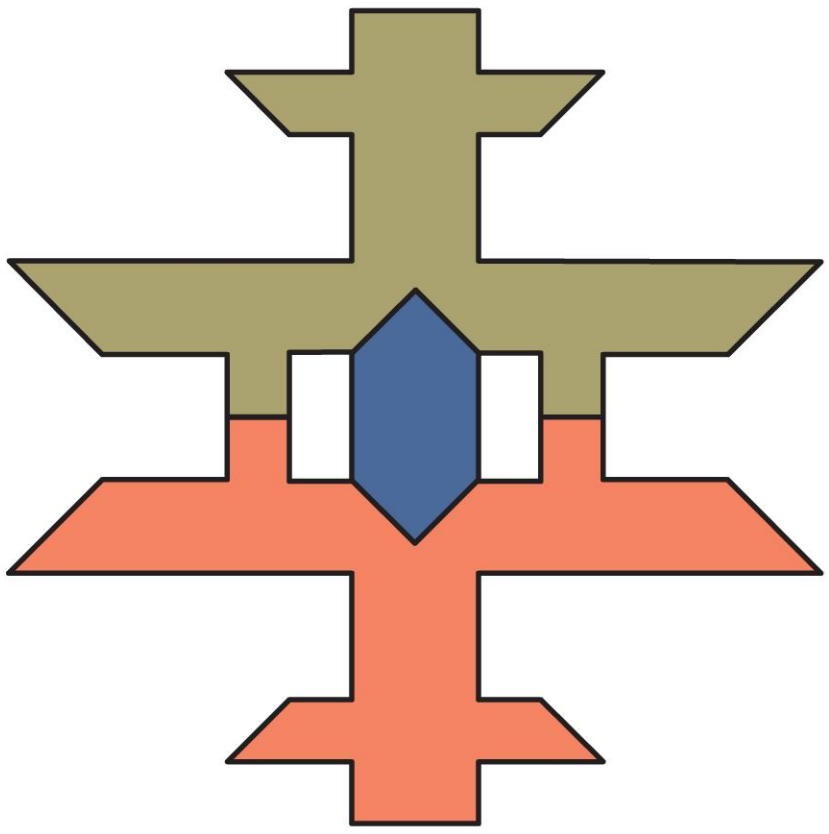

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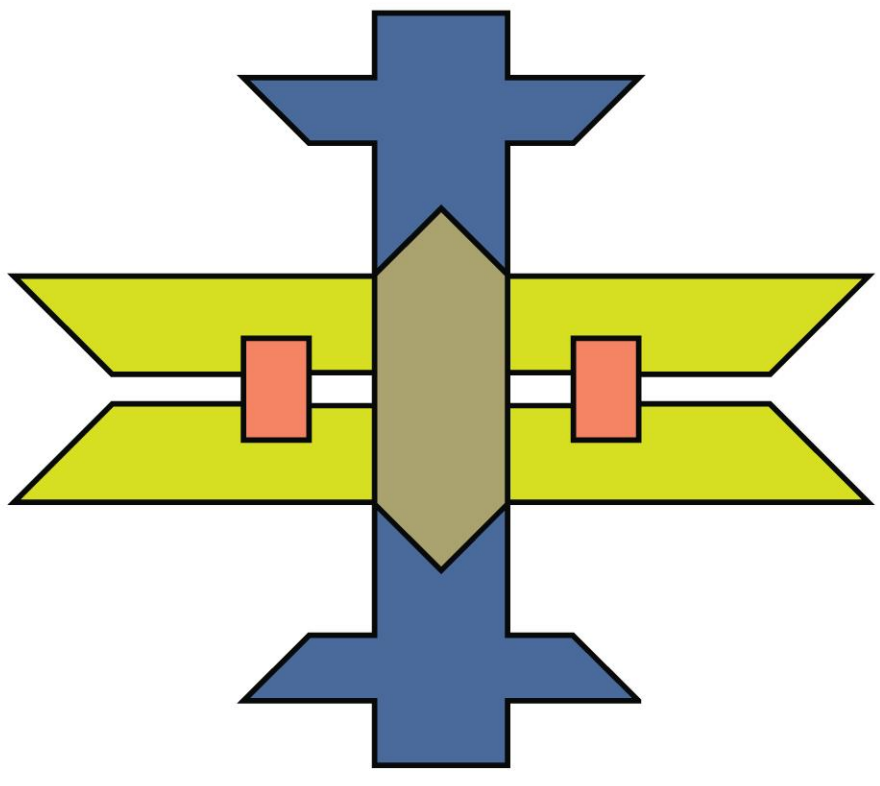

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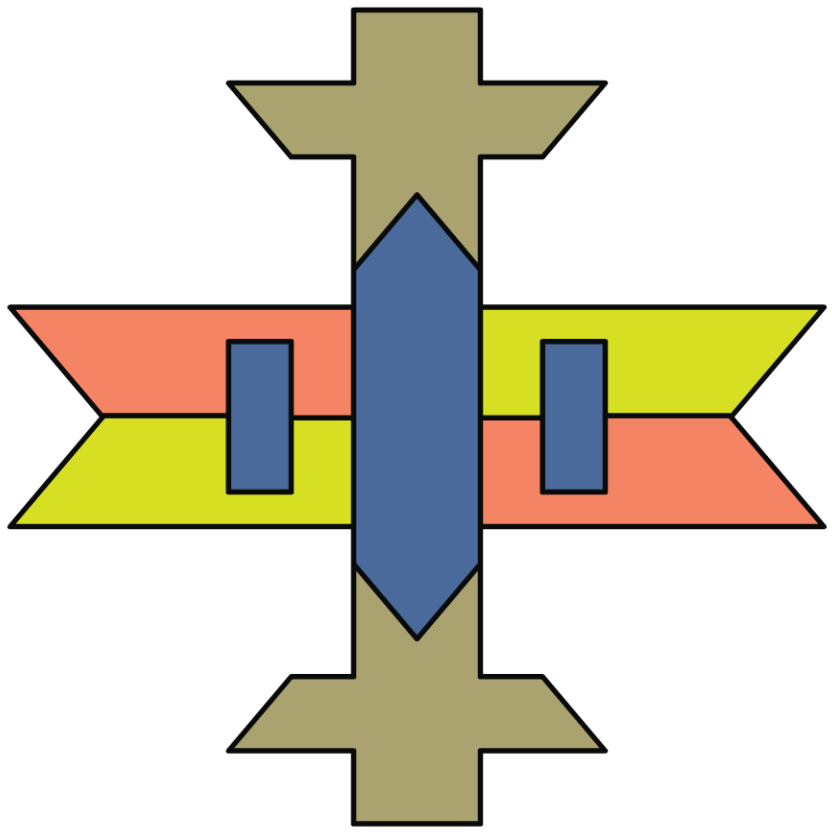

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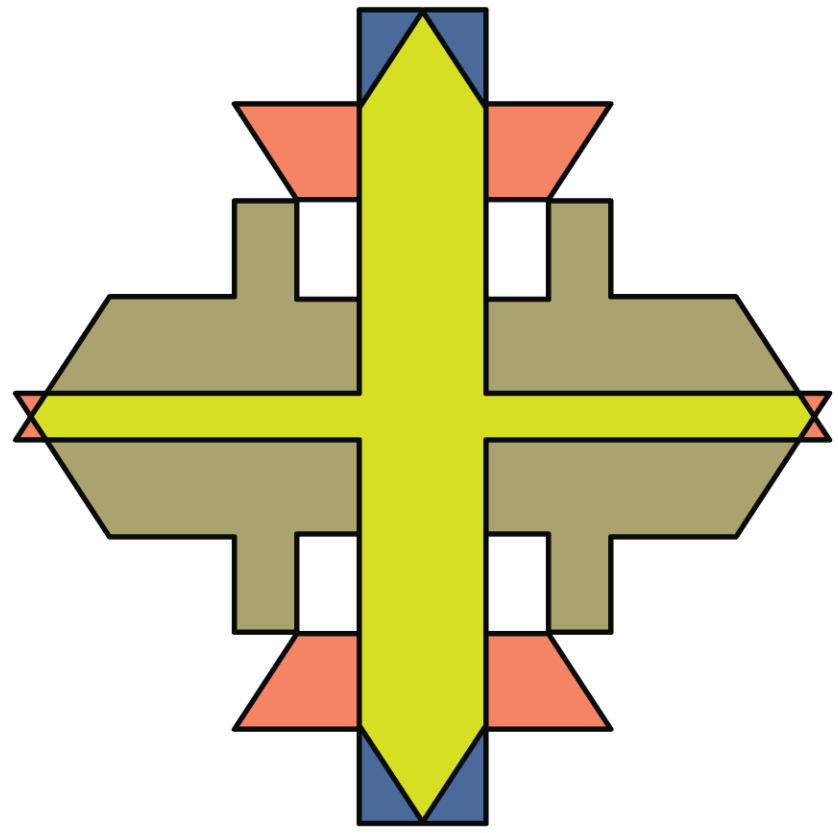

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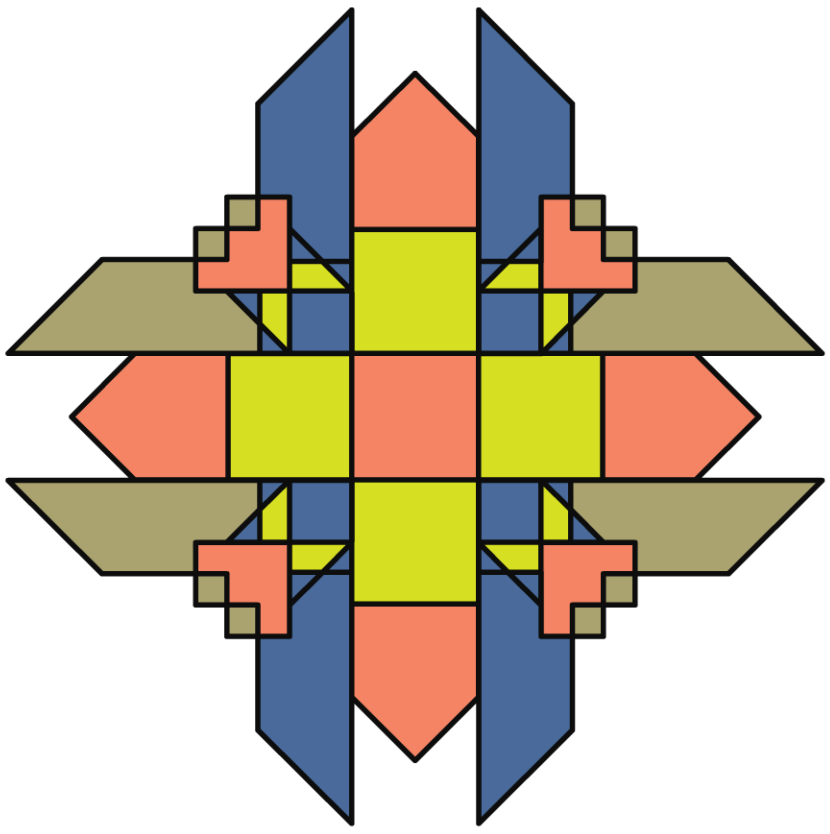

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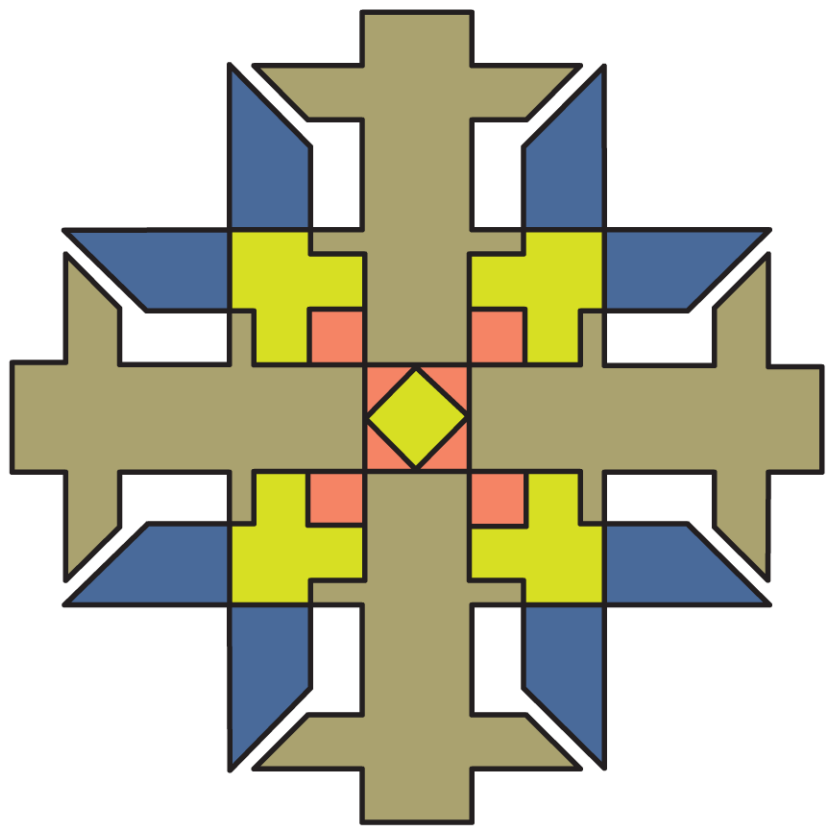

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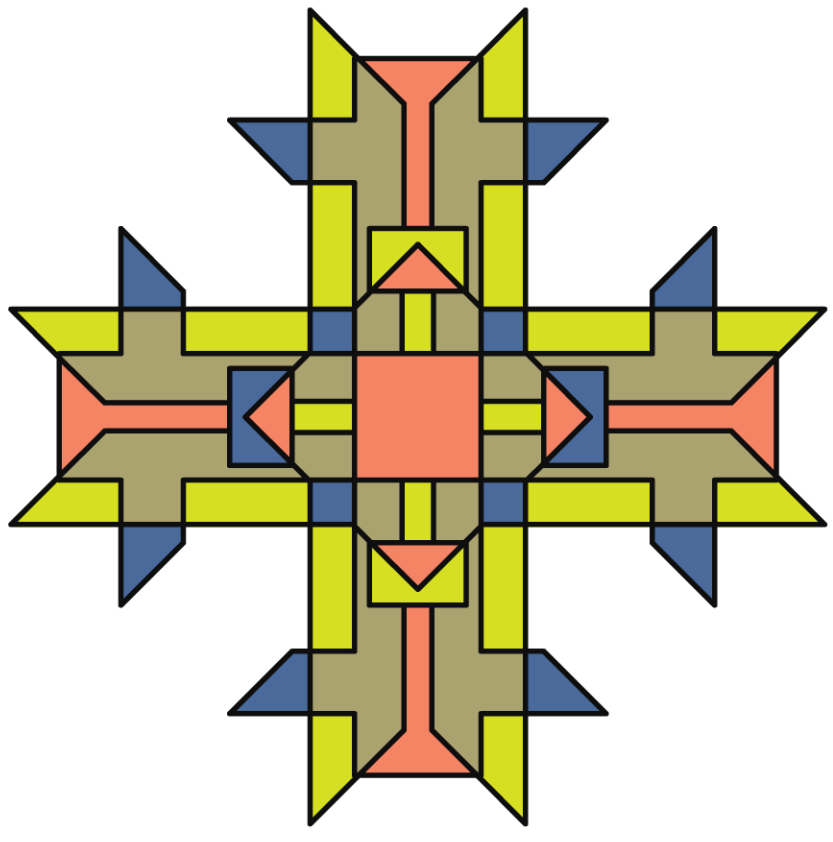

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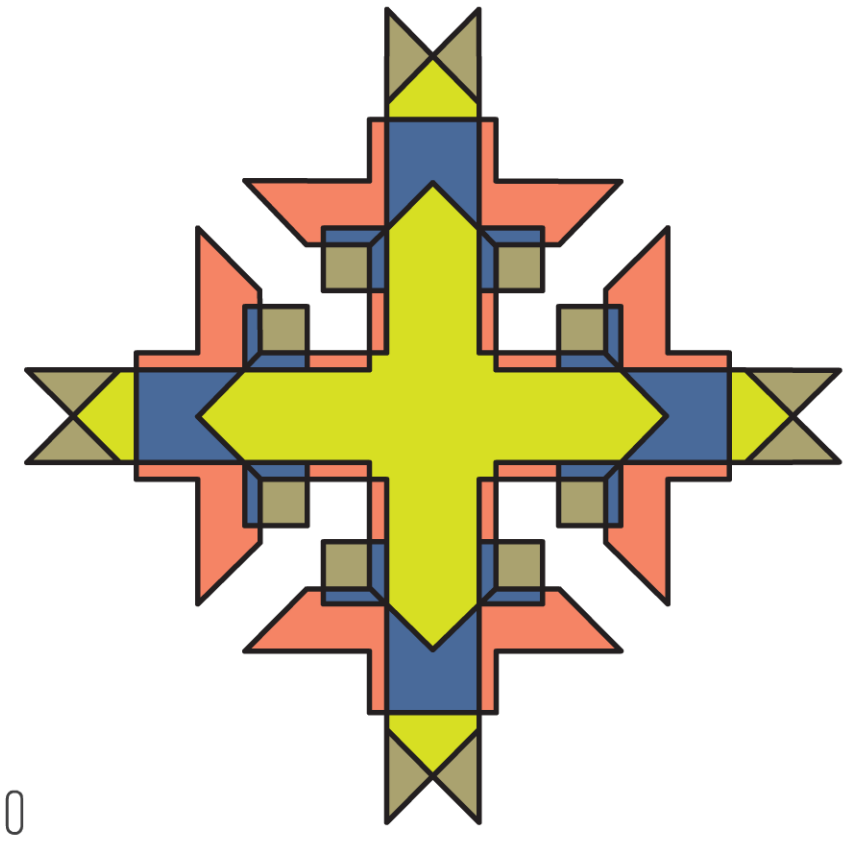

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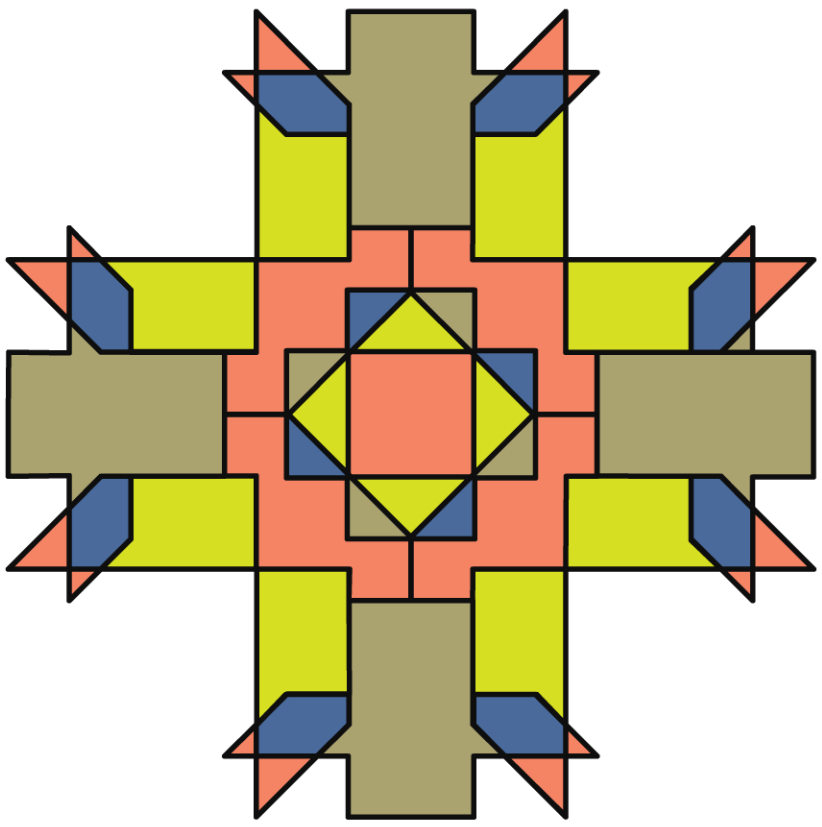

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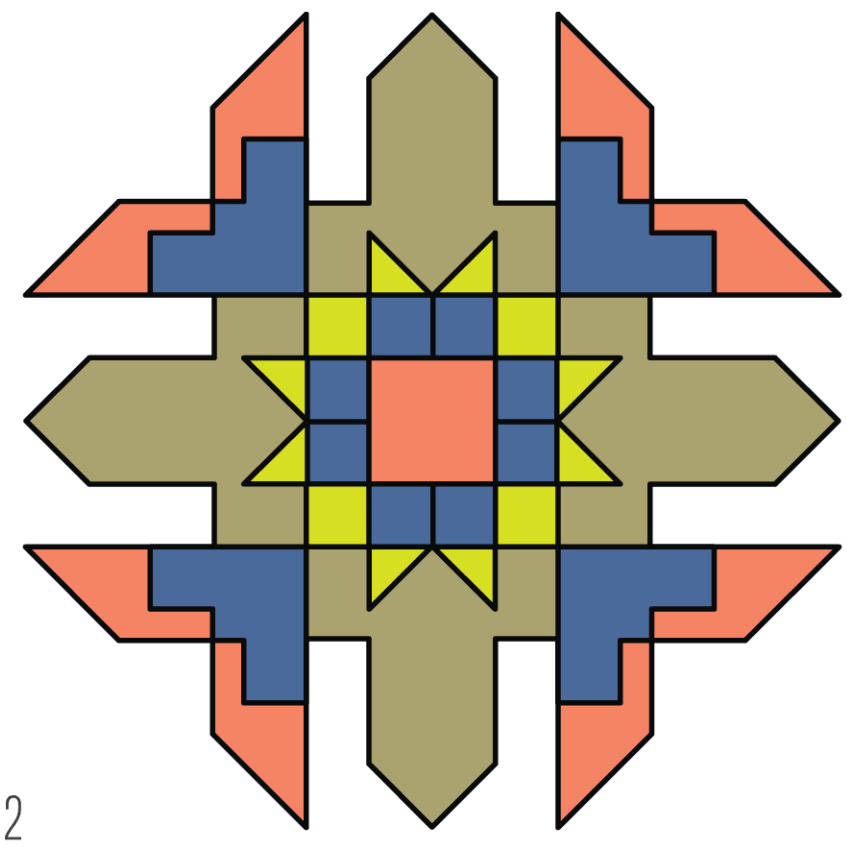

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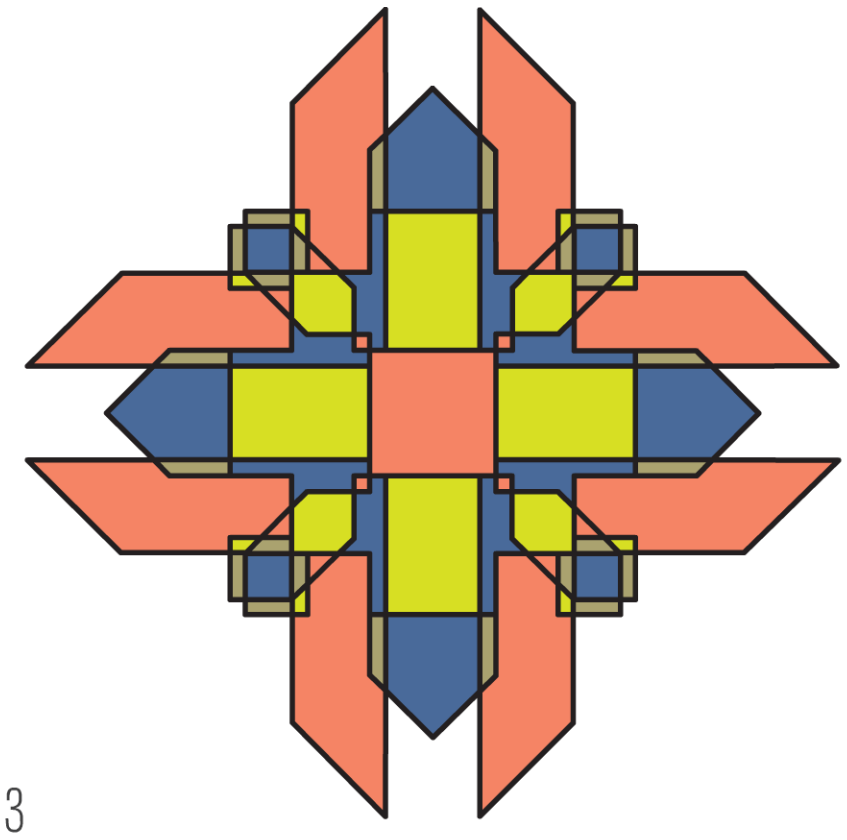

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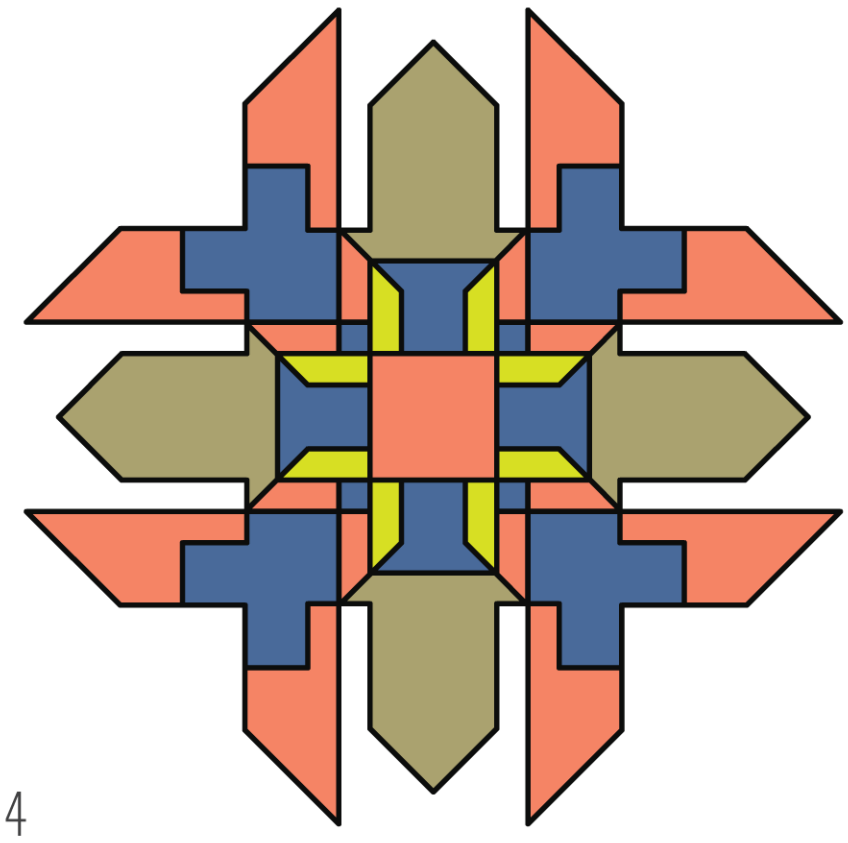

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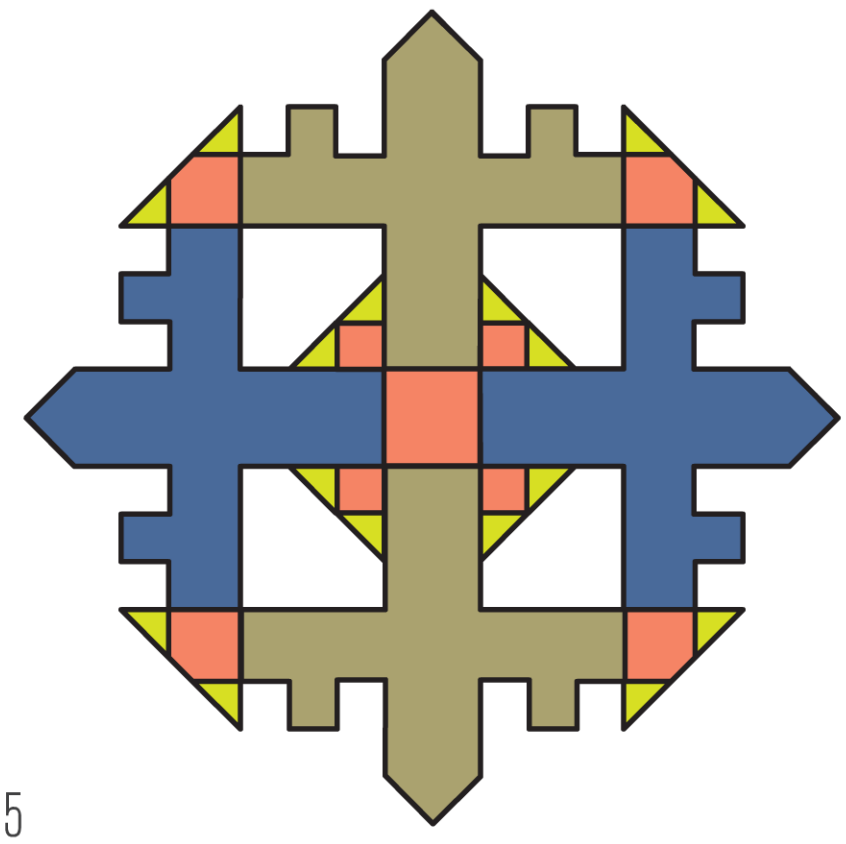

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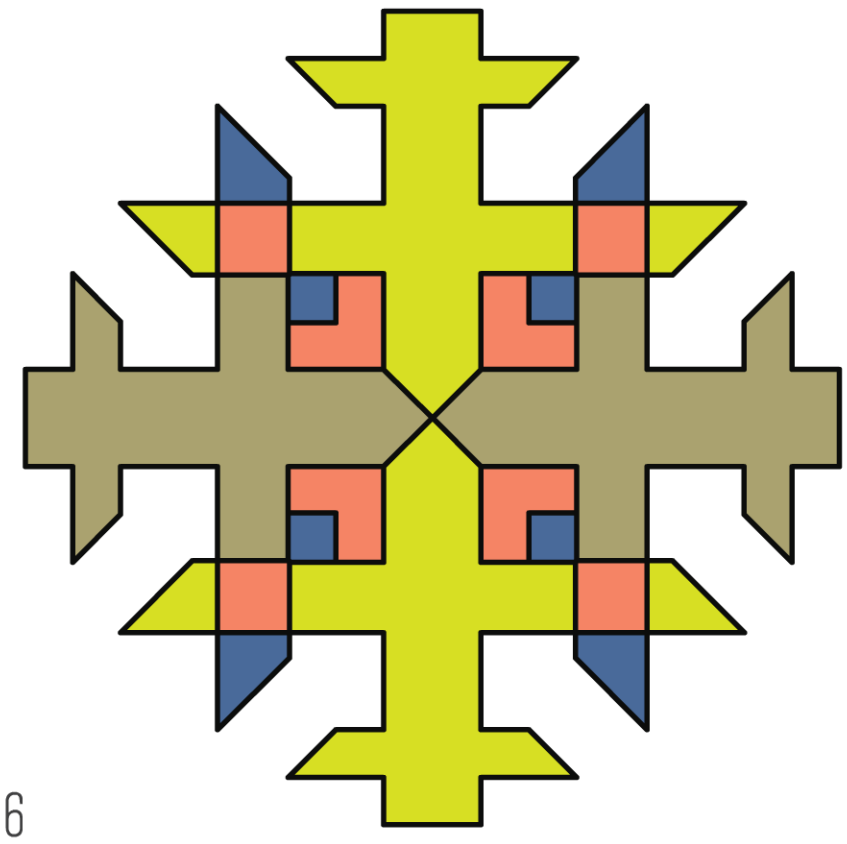

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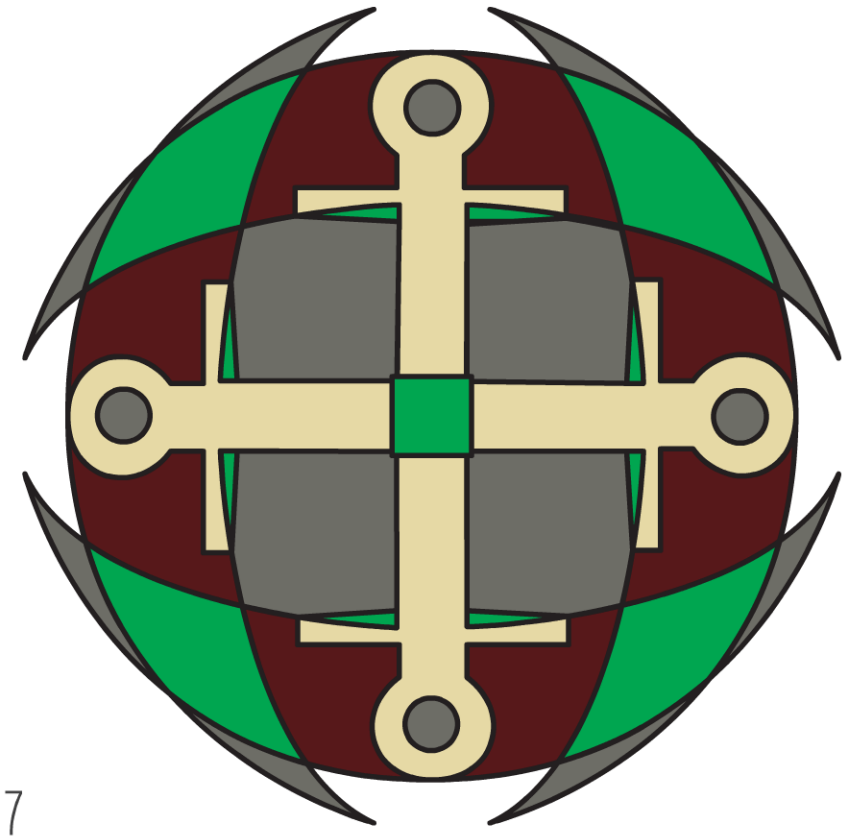

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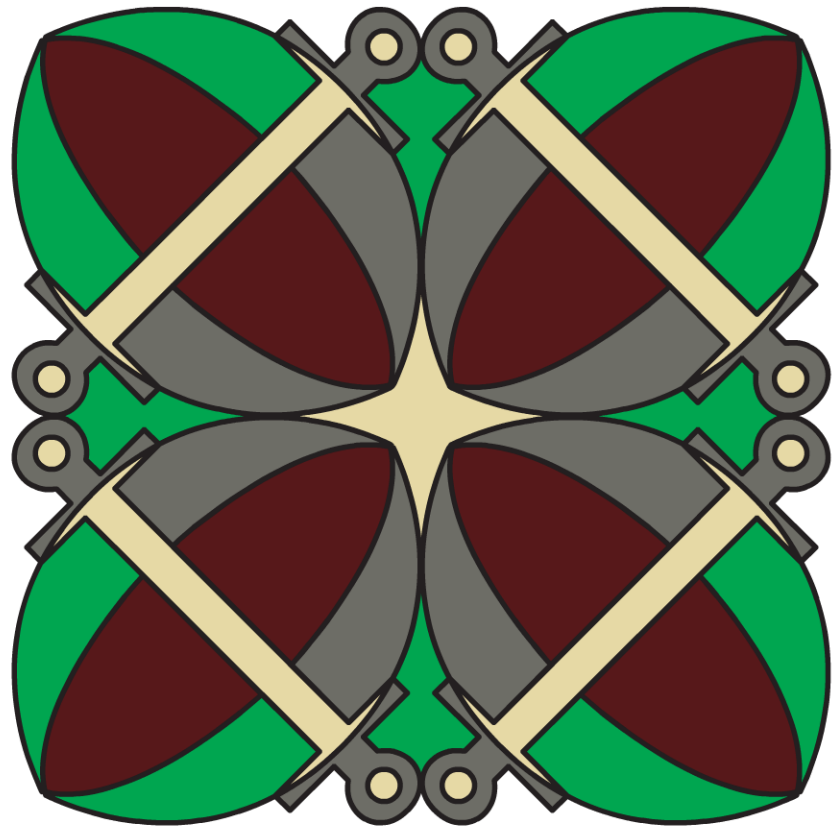

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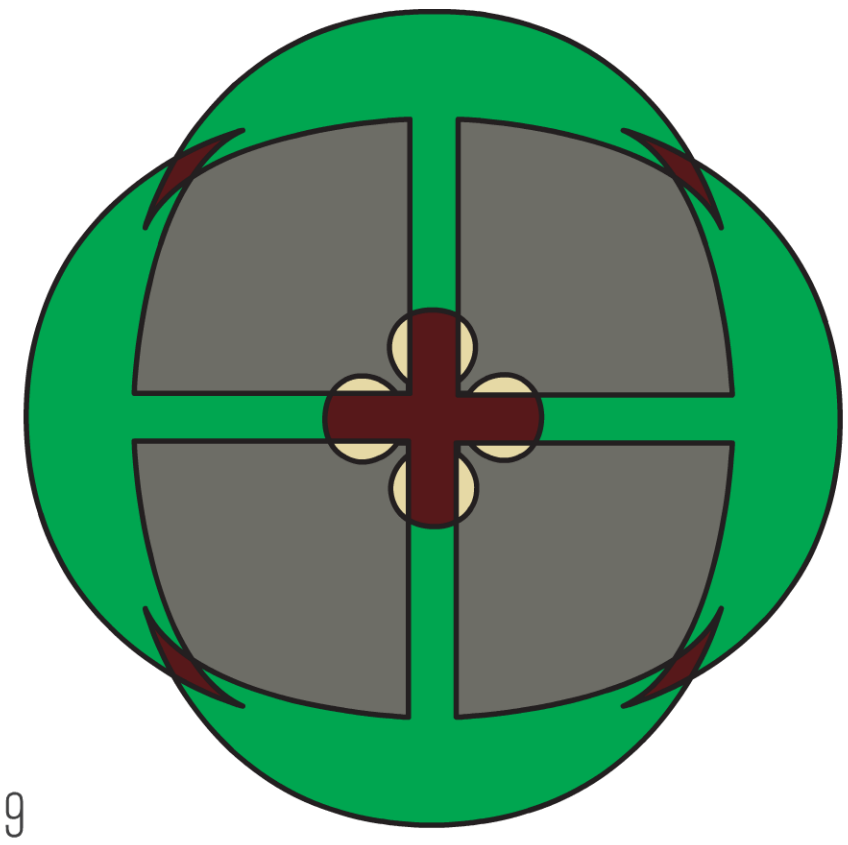

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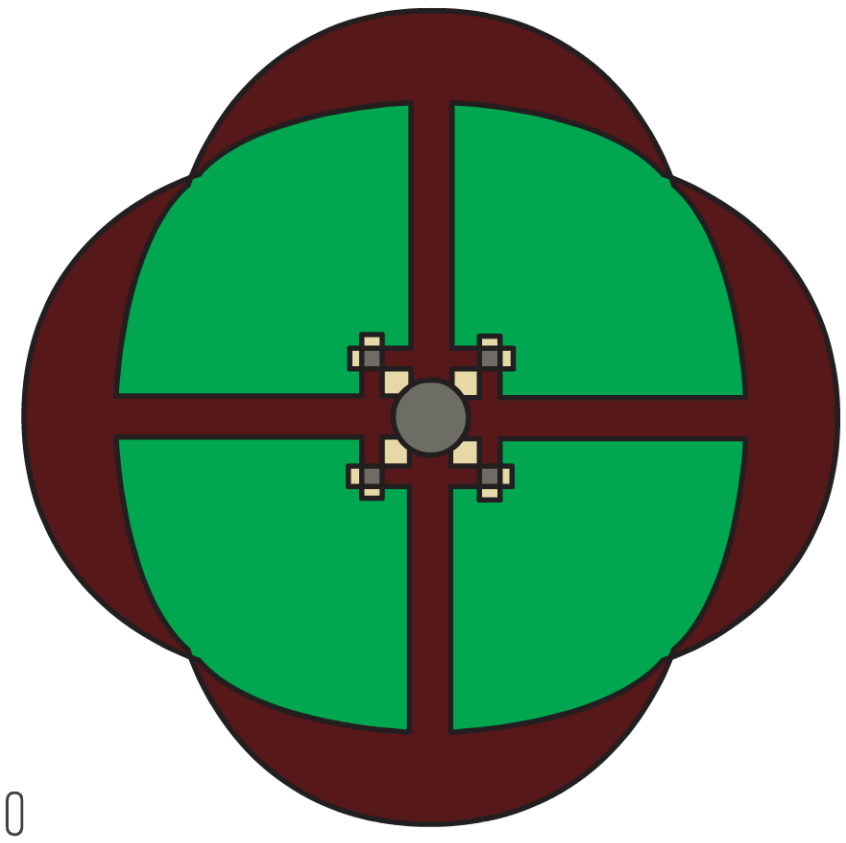

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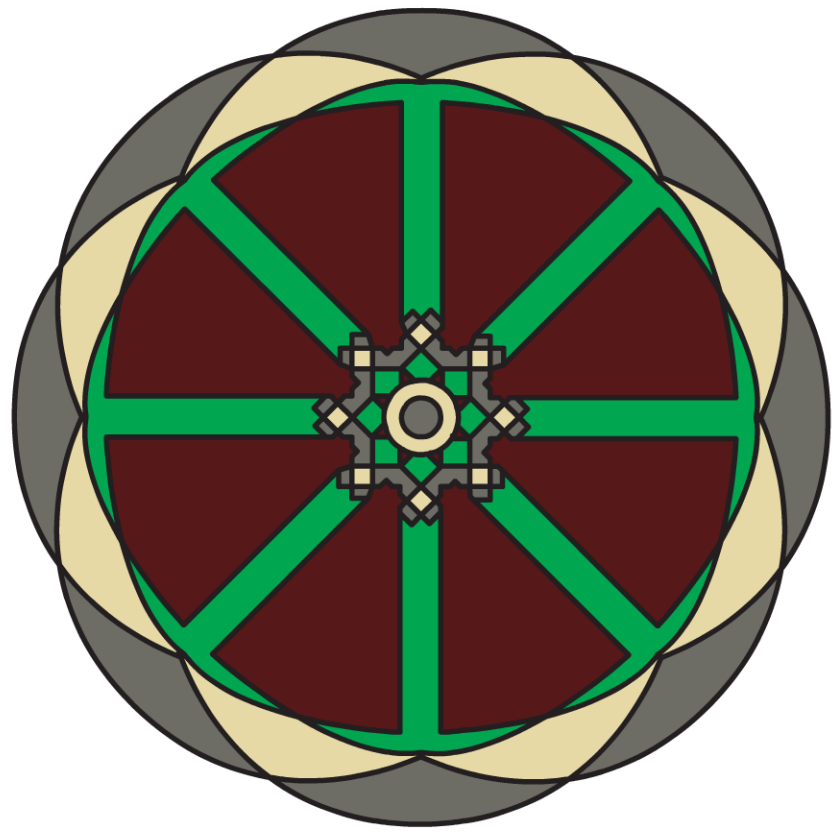

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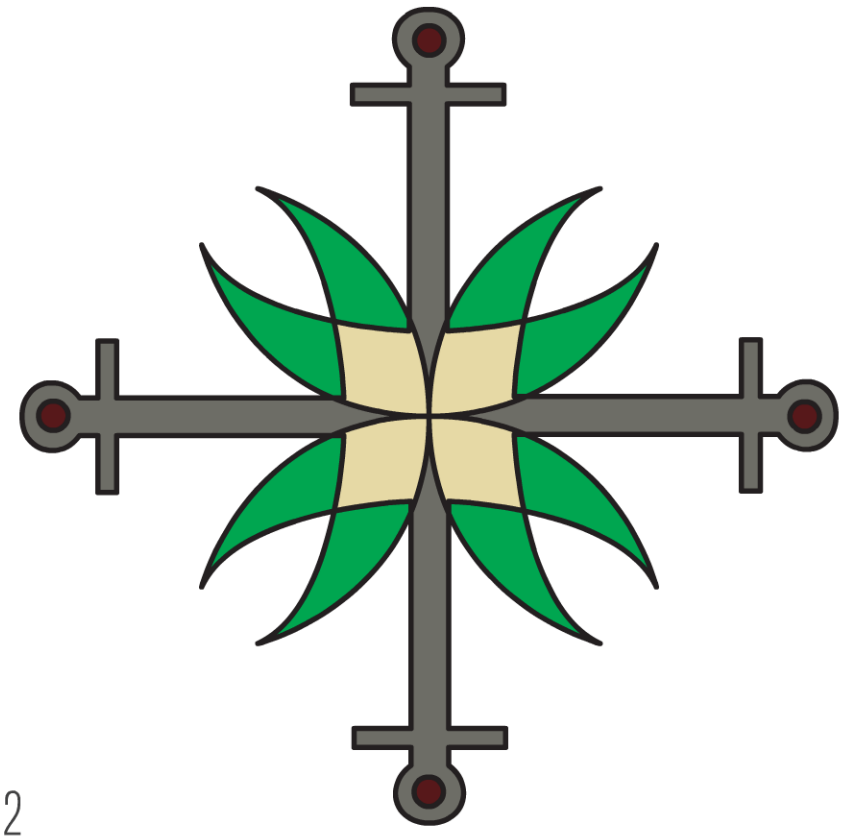

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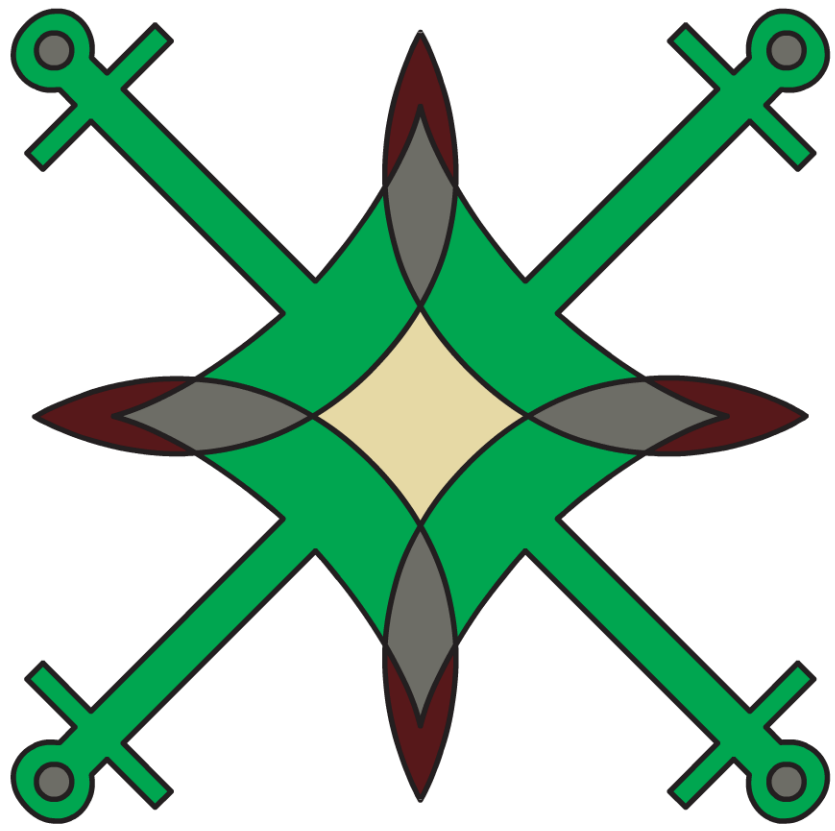

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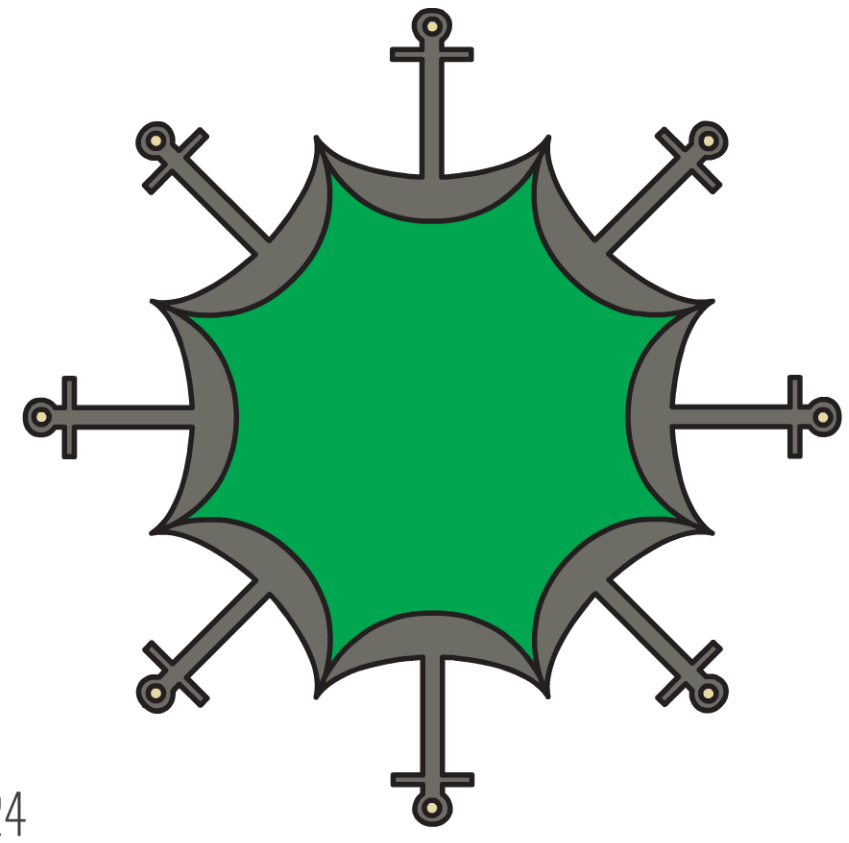

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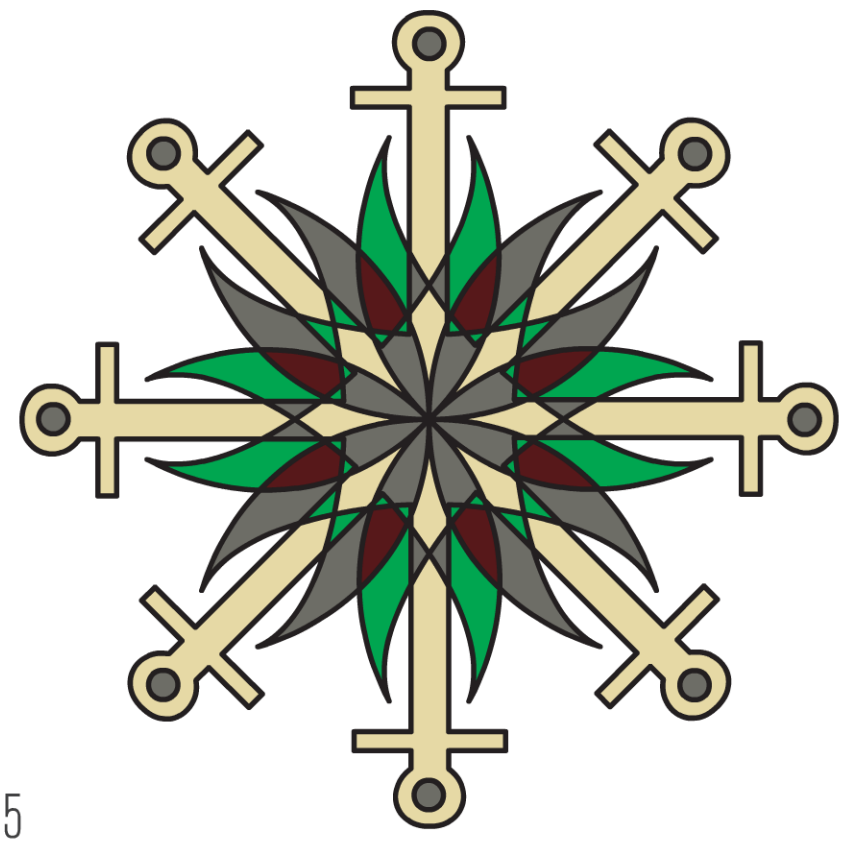

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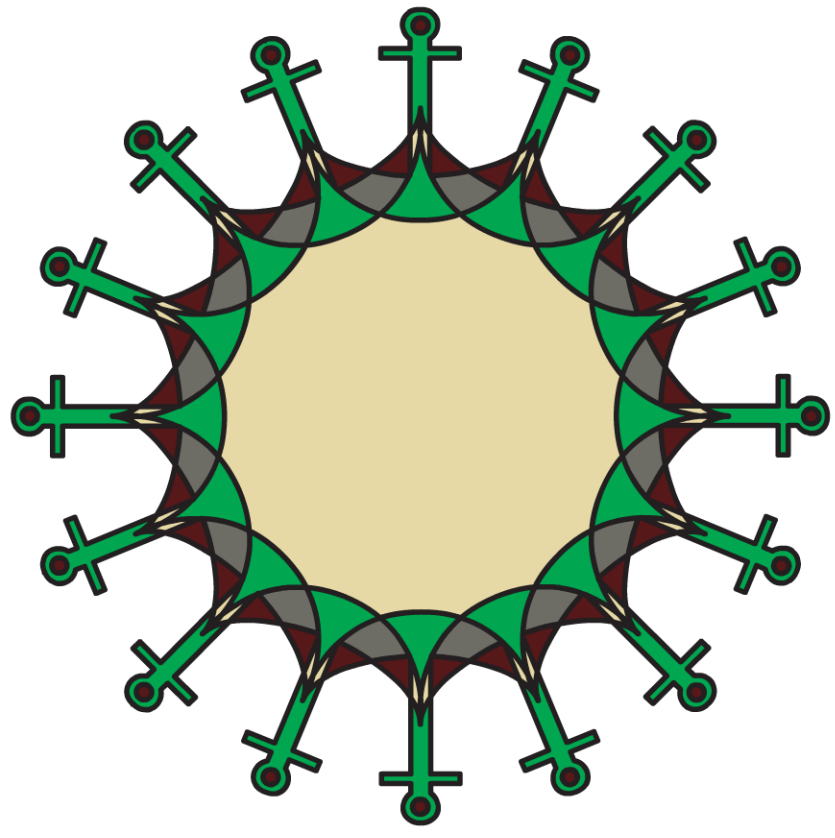

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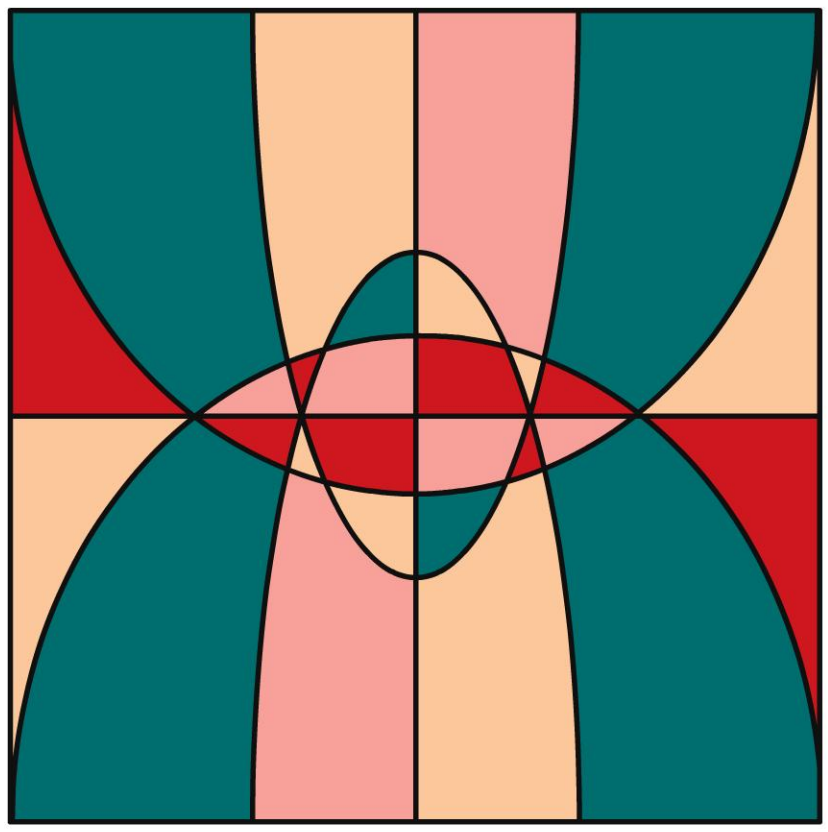

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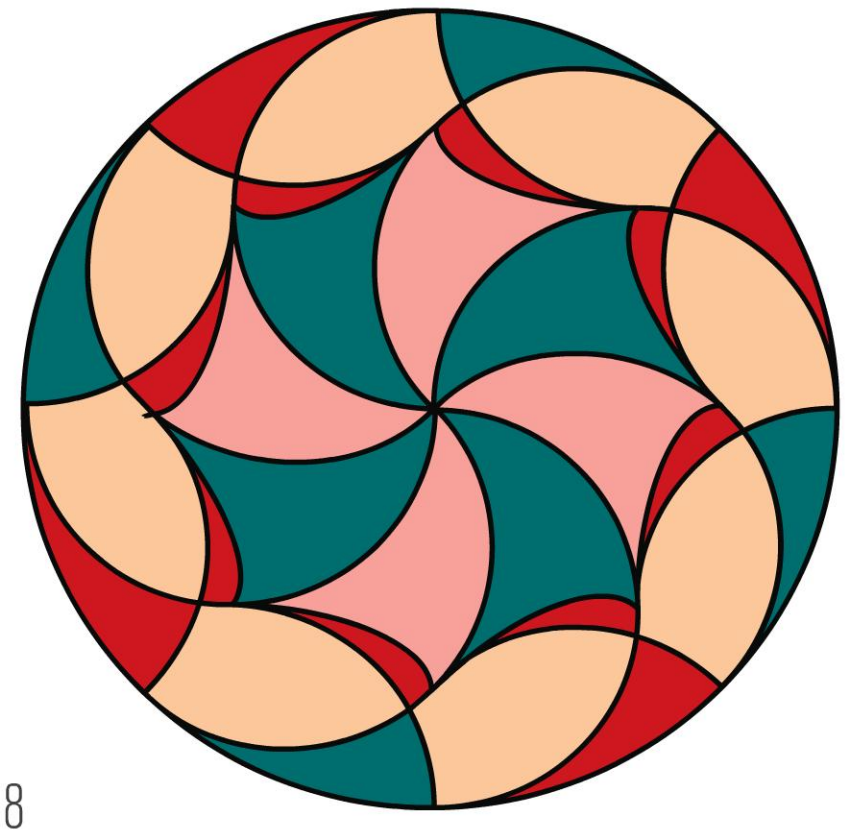

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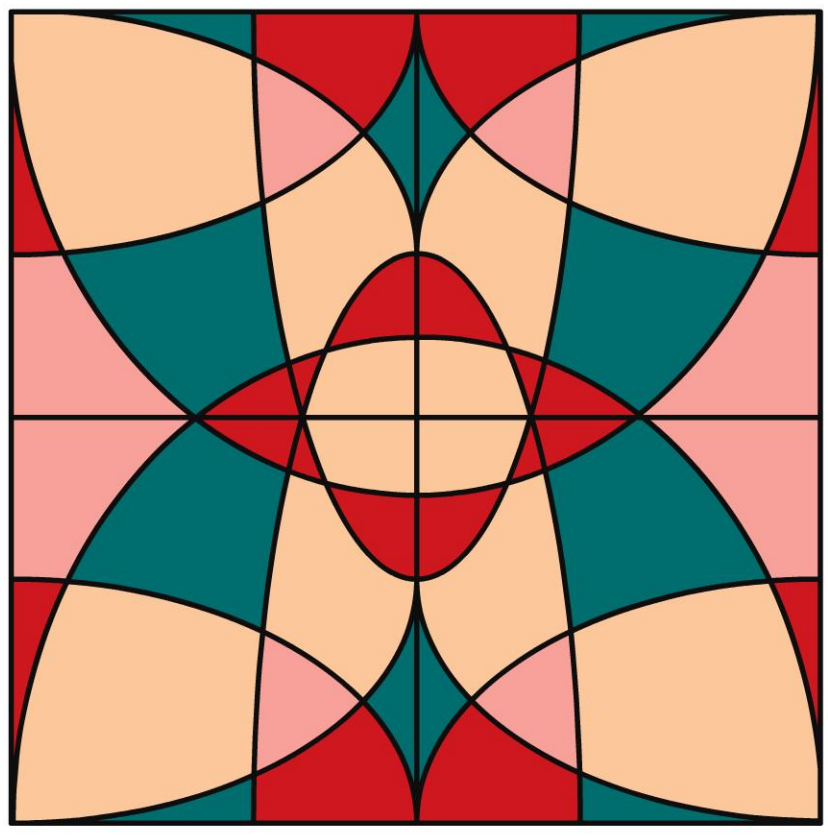

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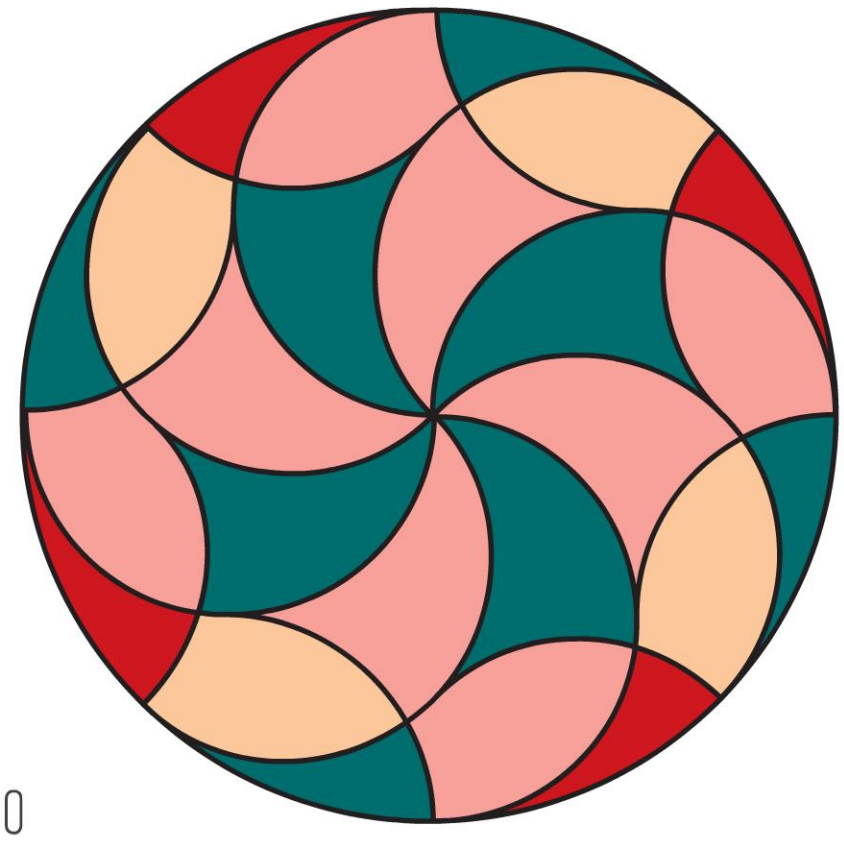

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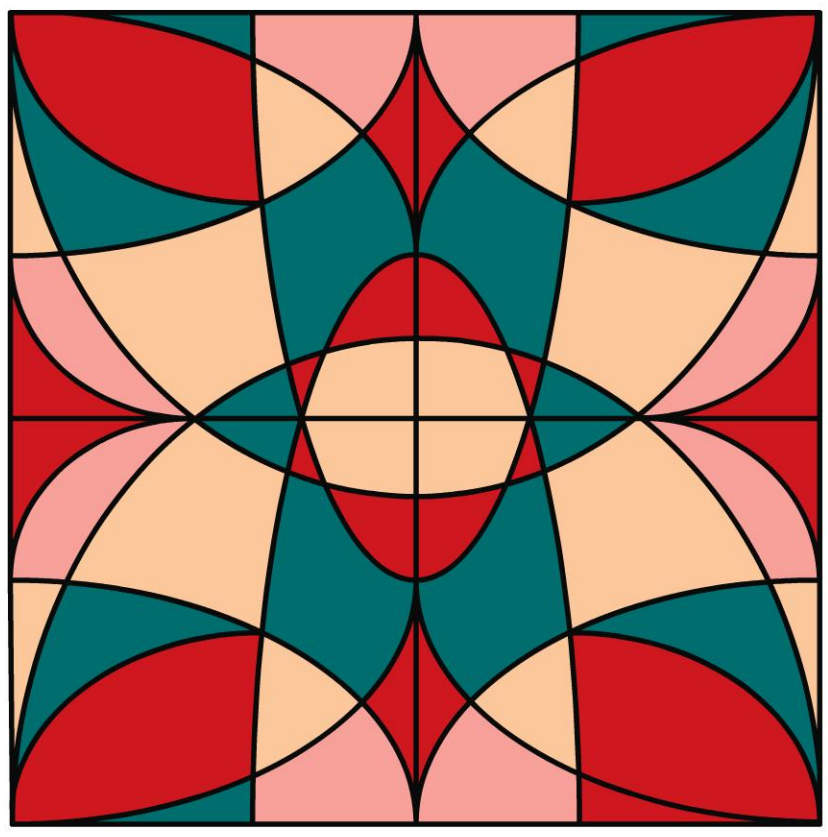

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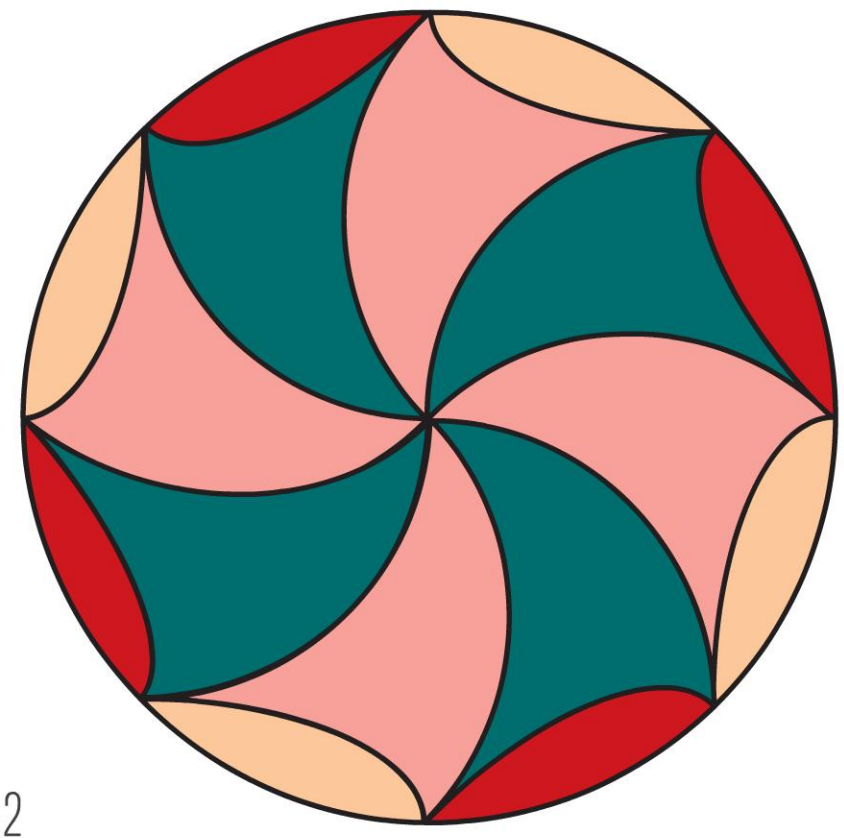

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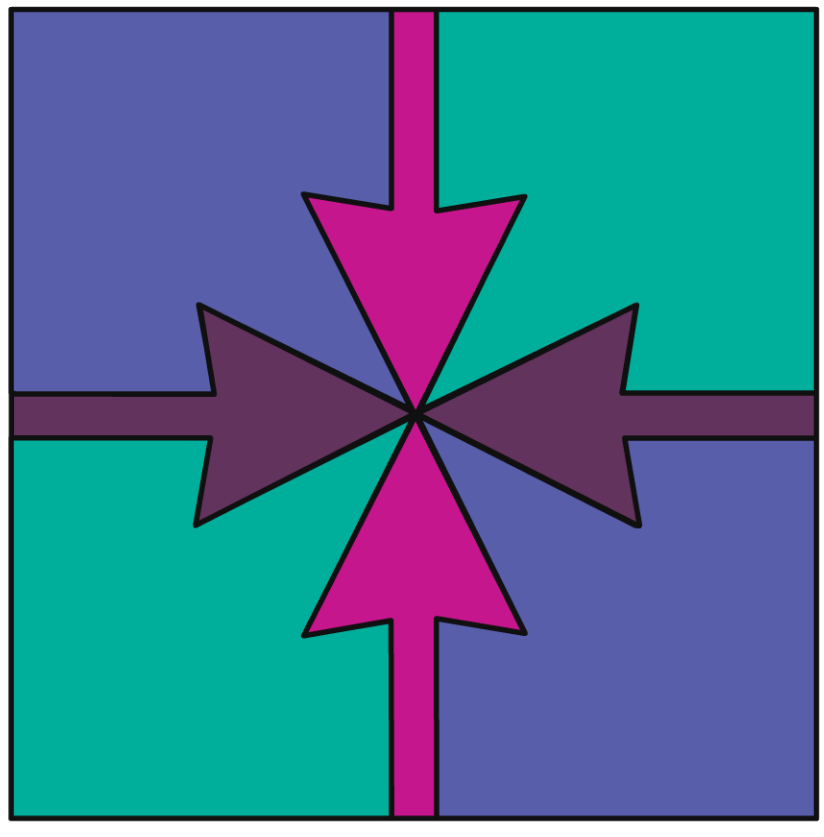

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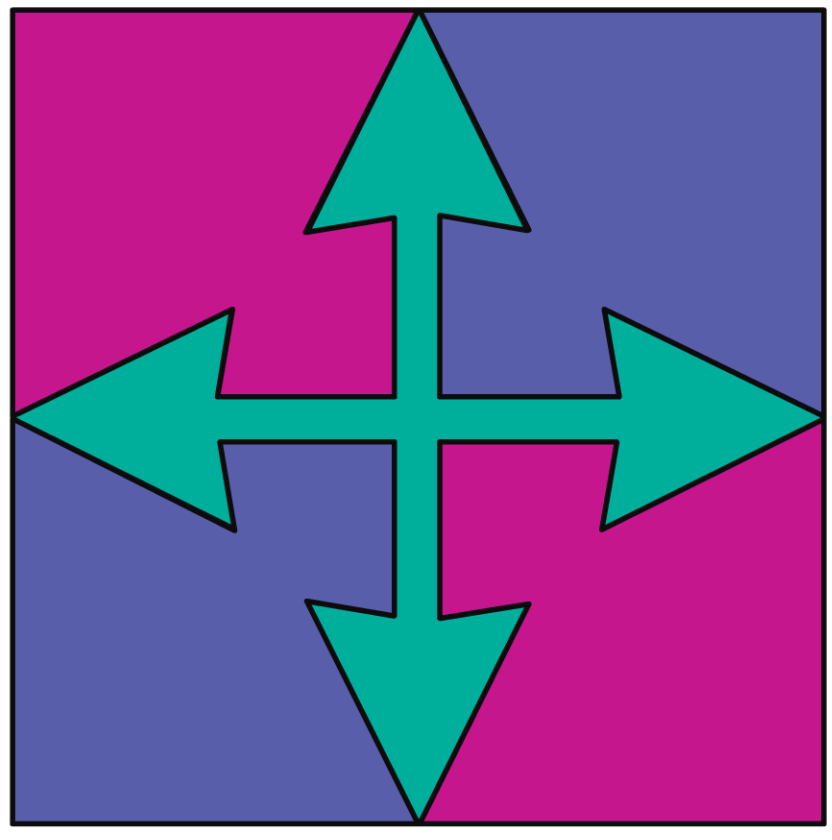

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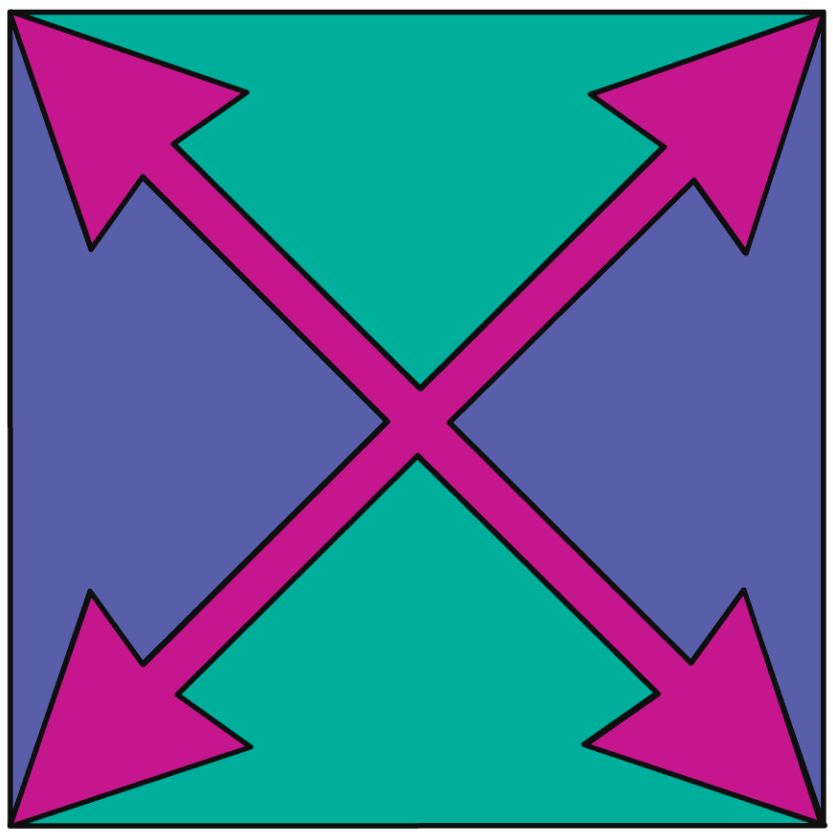

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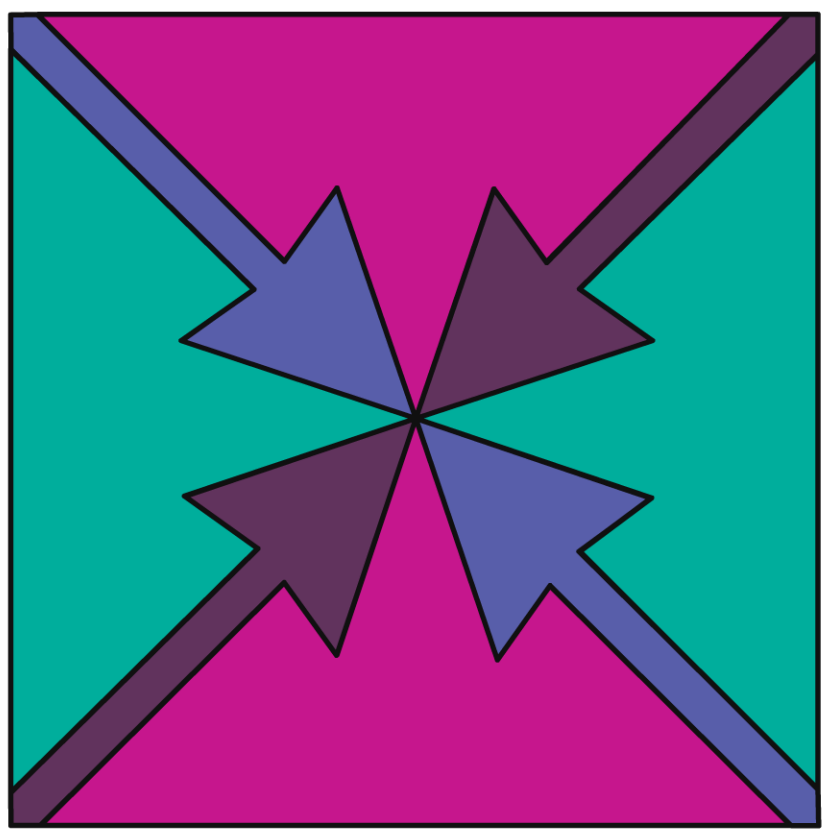

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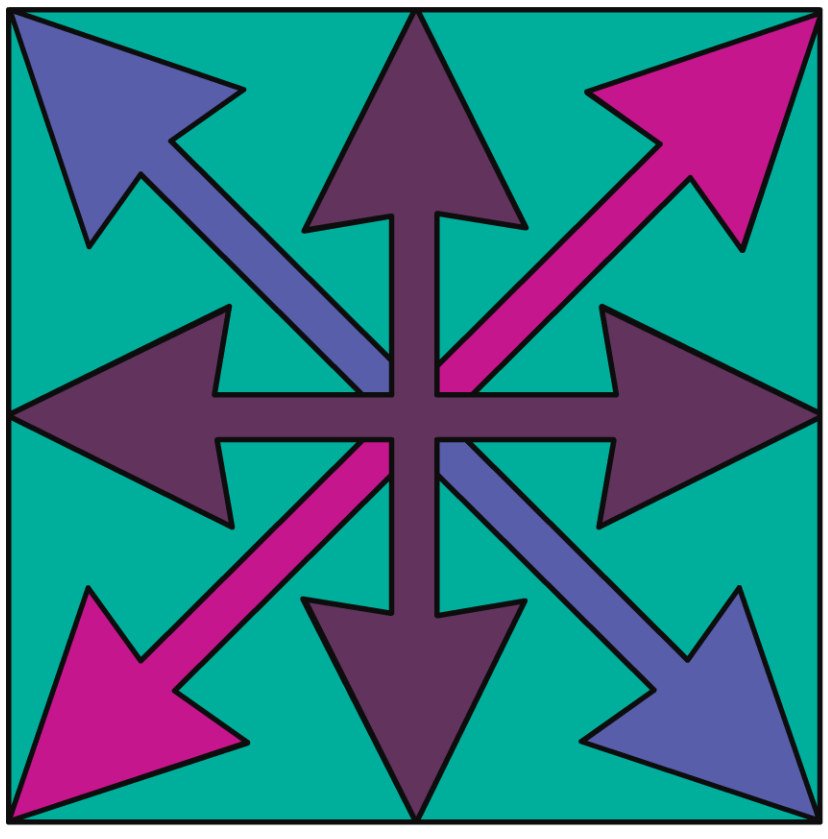

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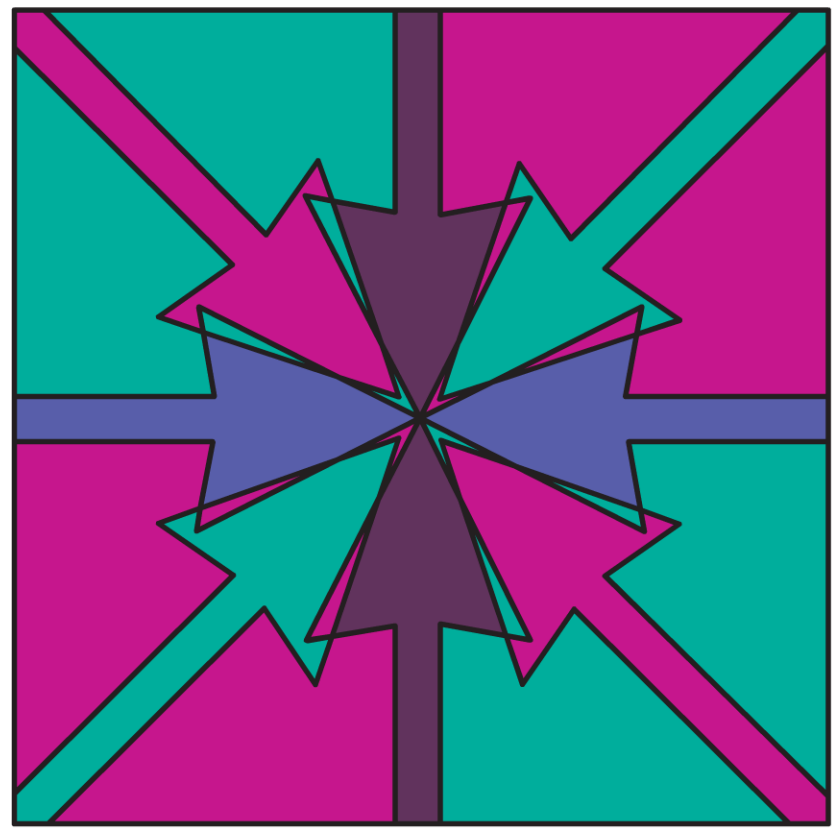

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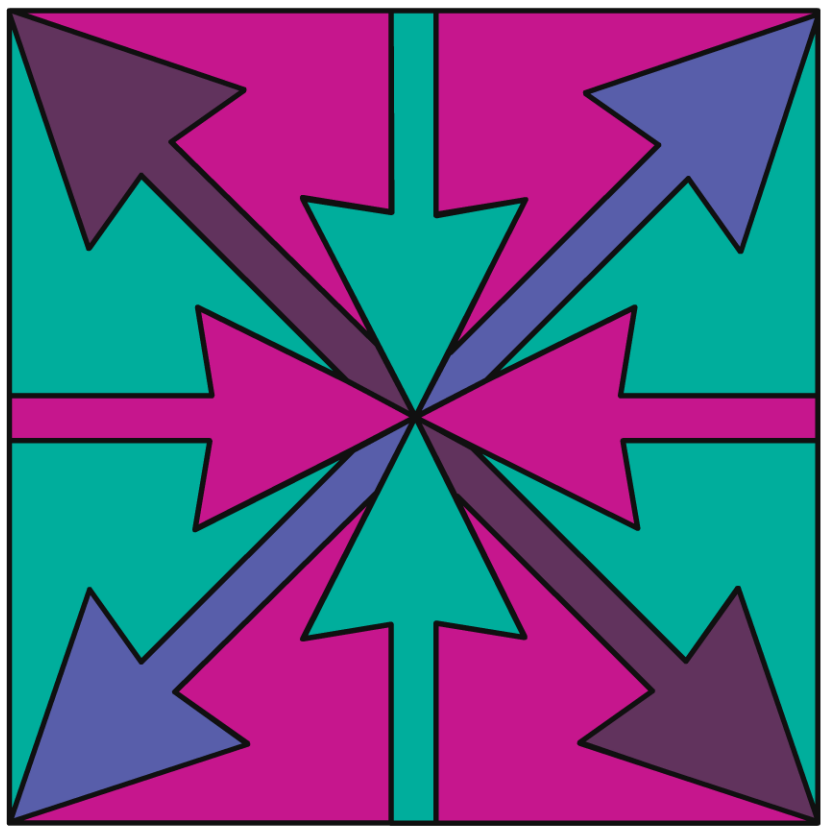

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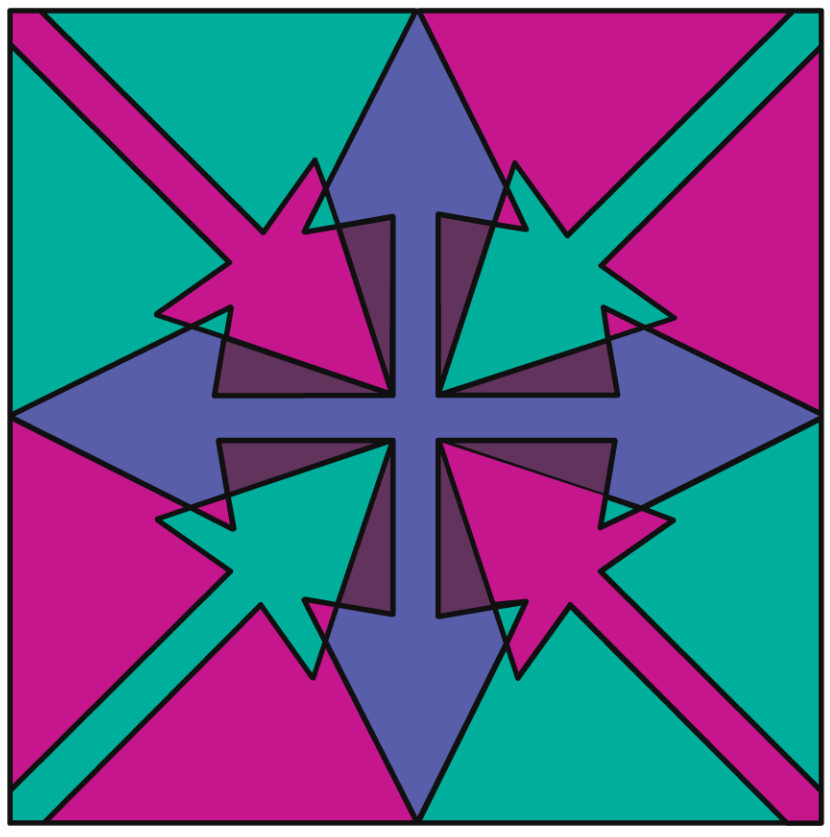

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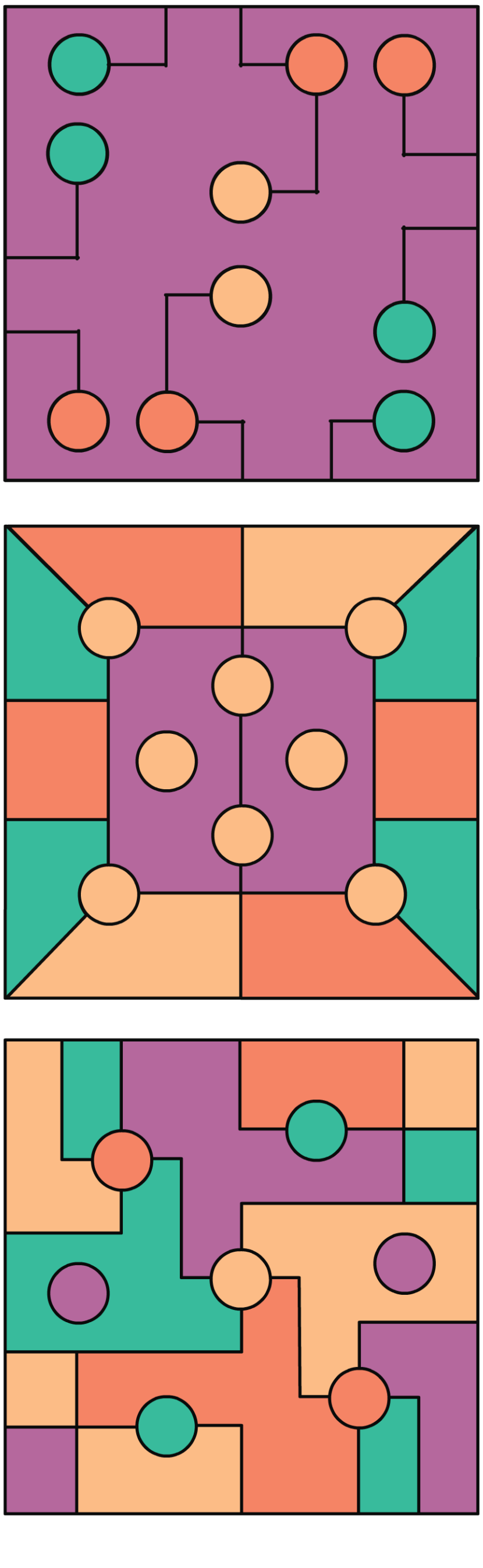

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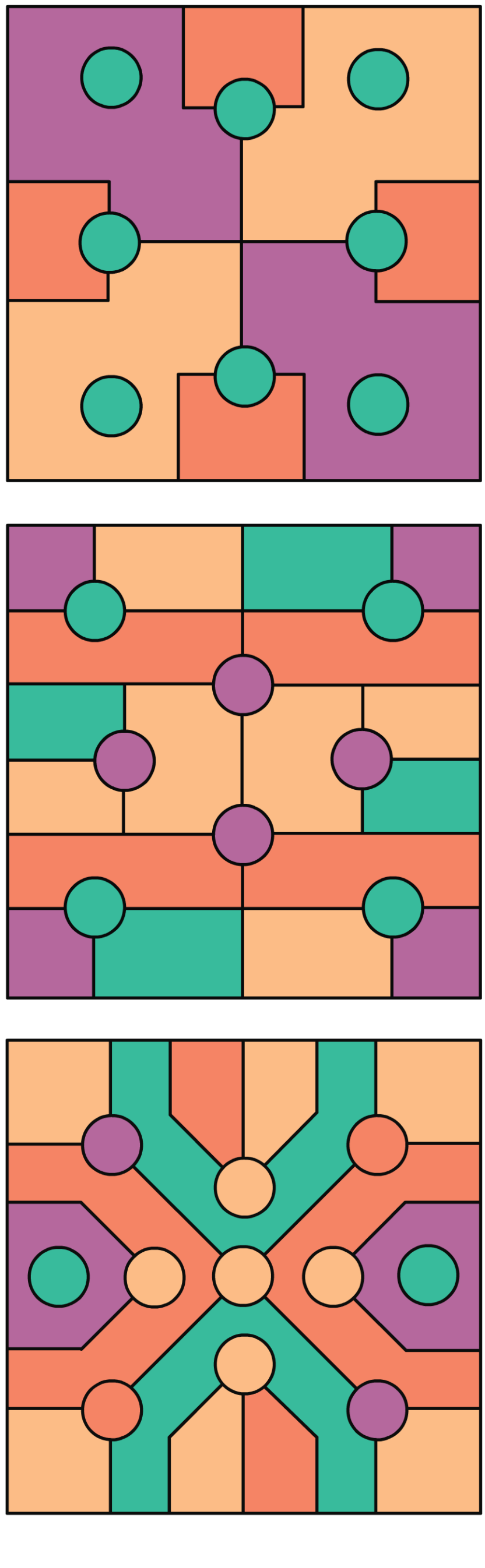

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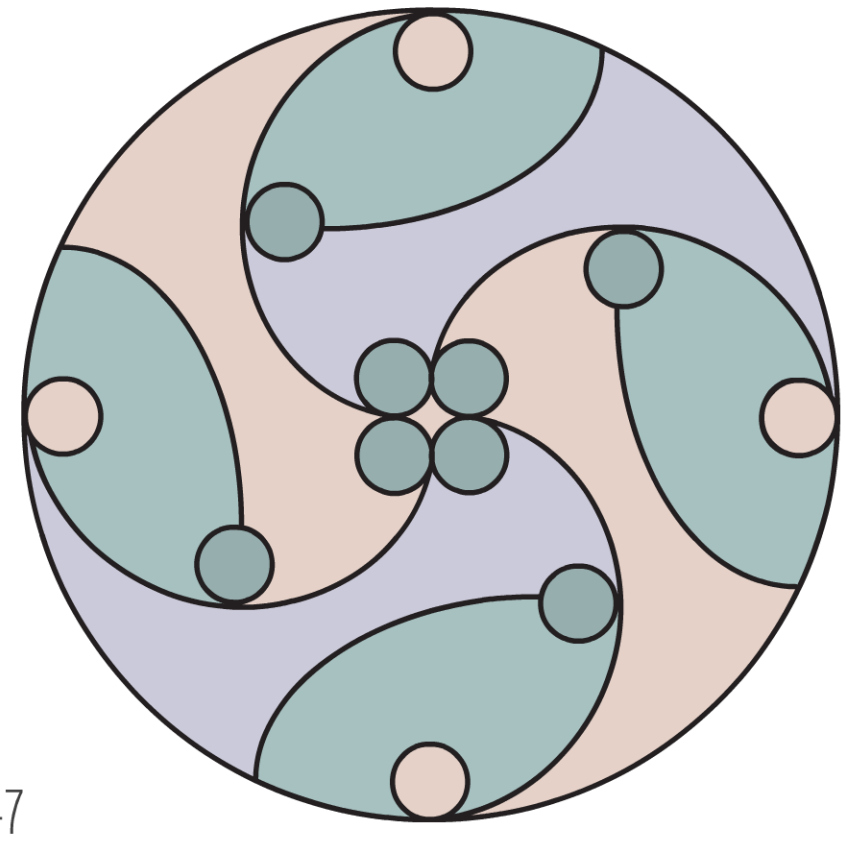
Ball & Spiral



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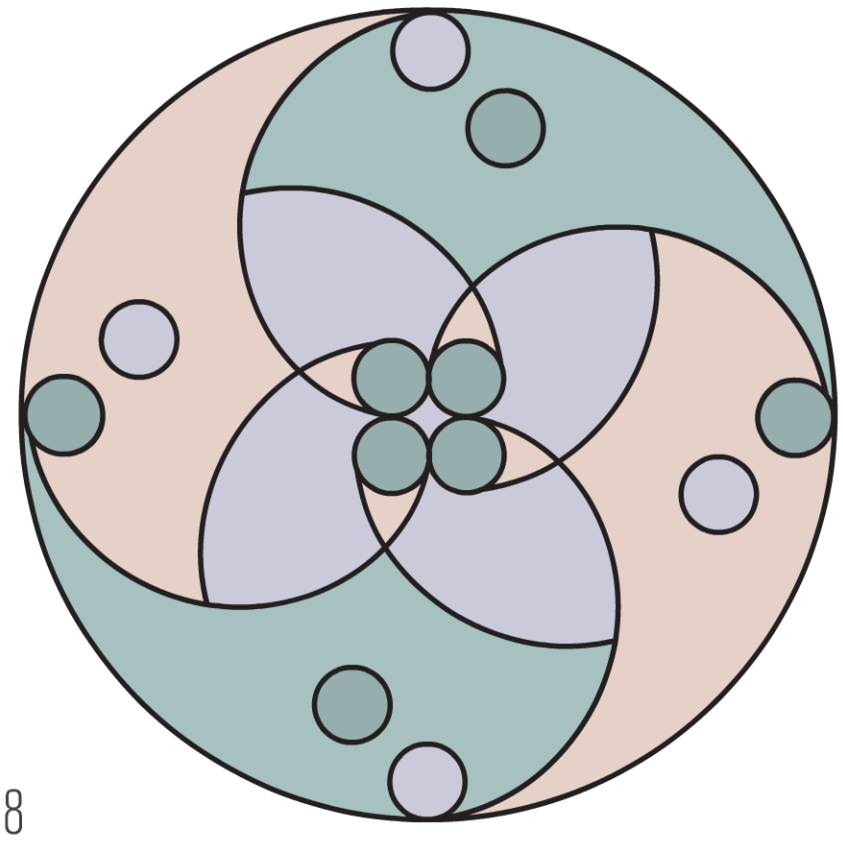

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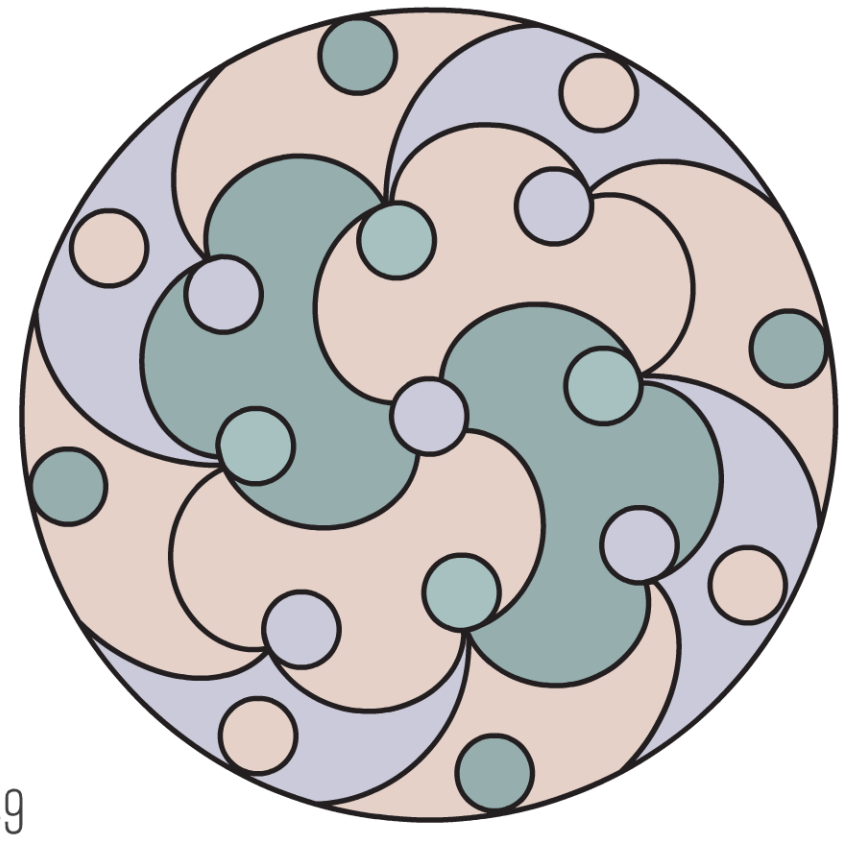

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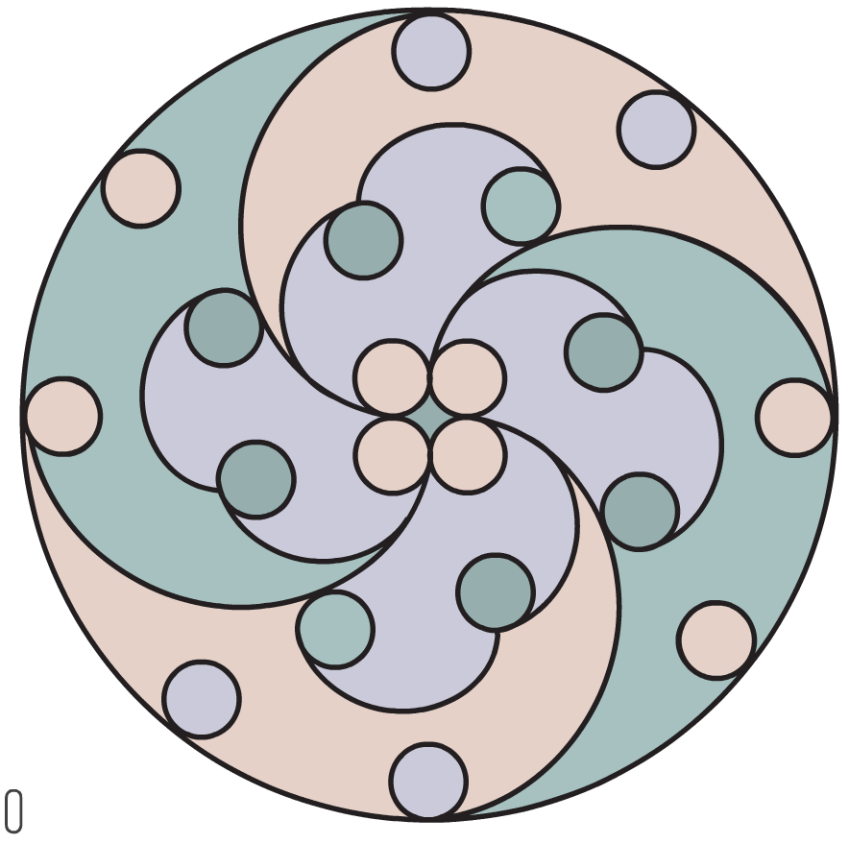

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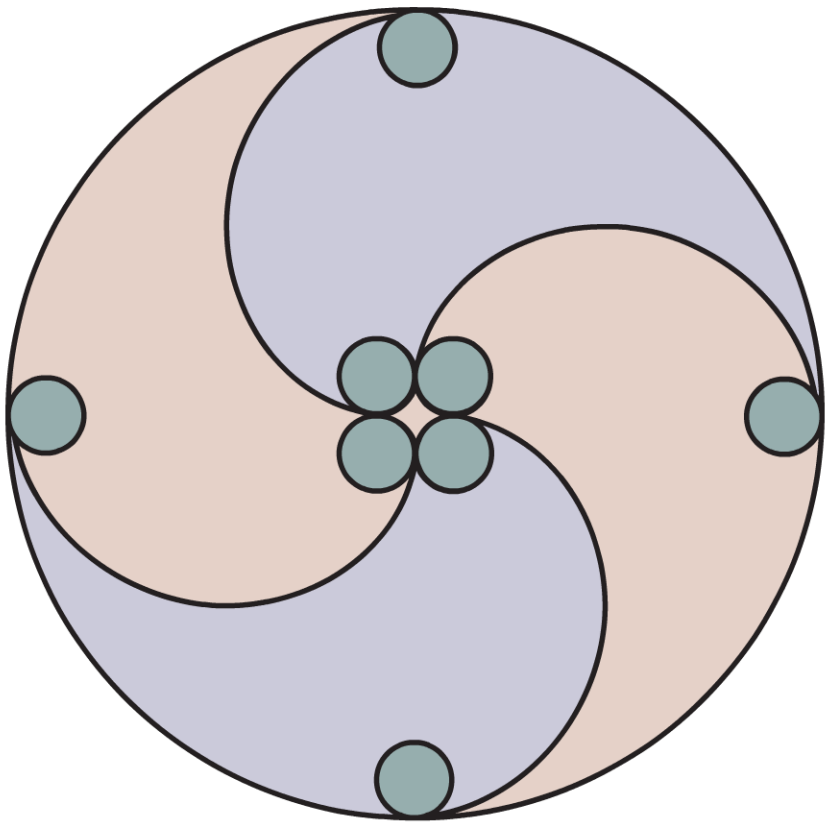

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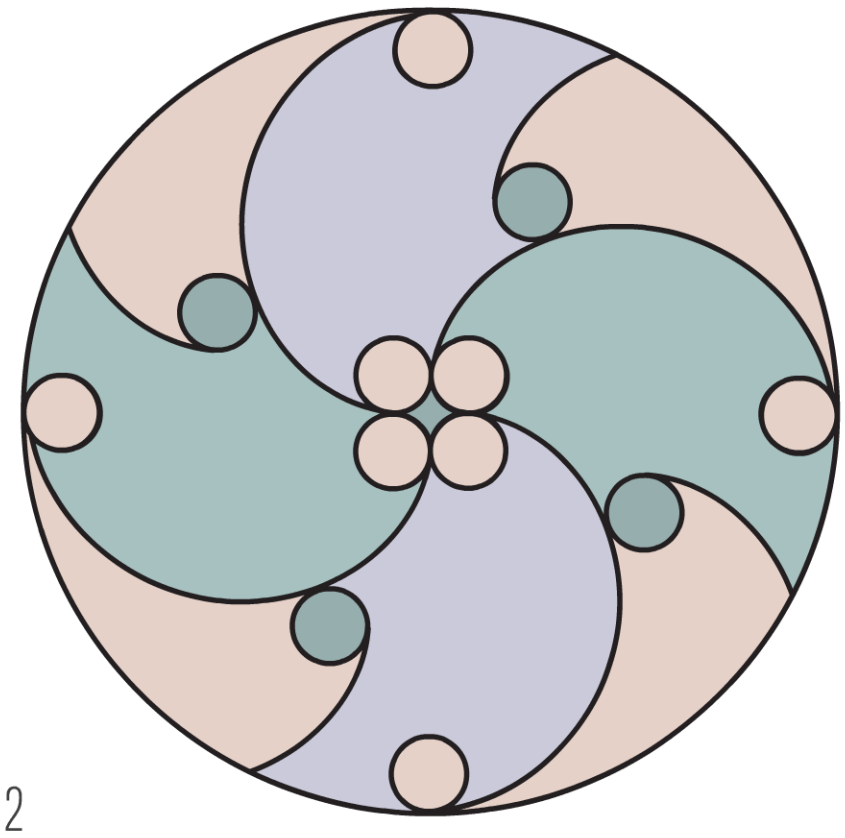

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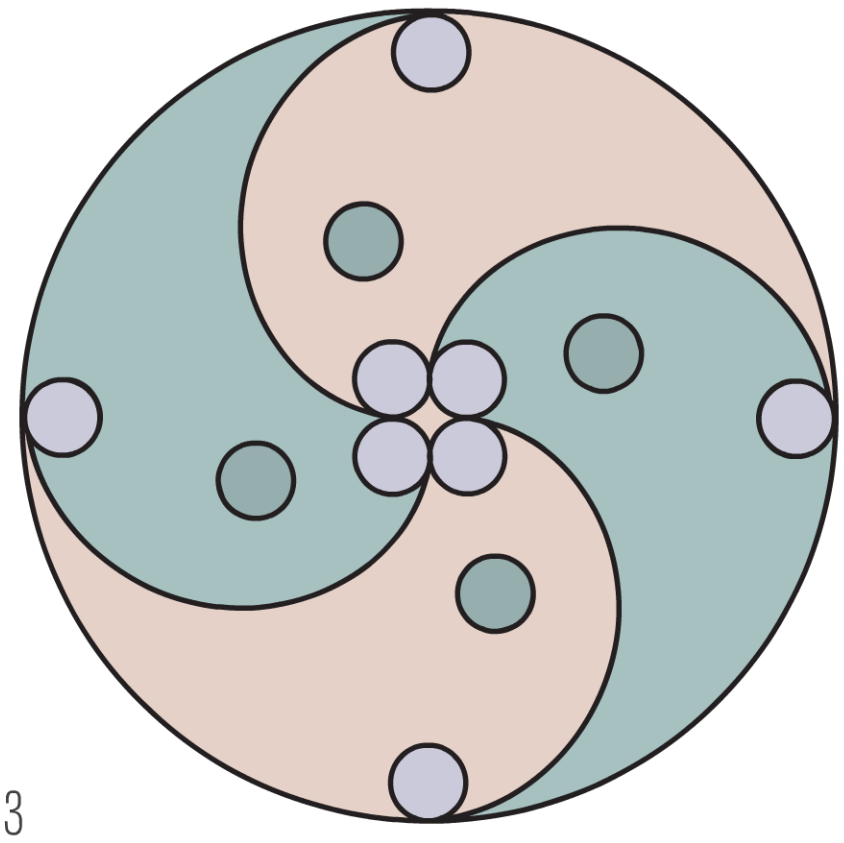

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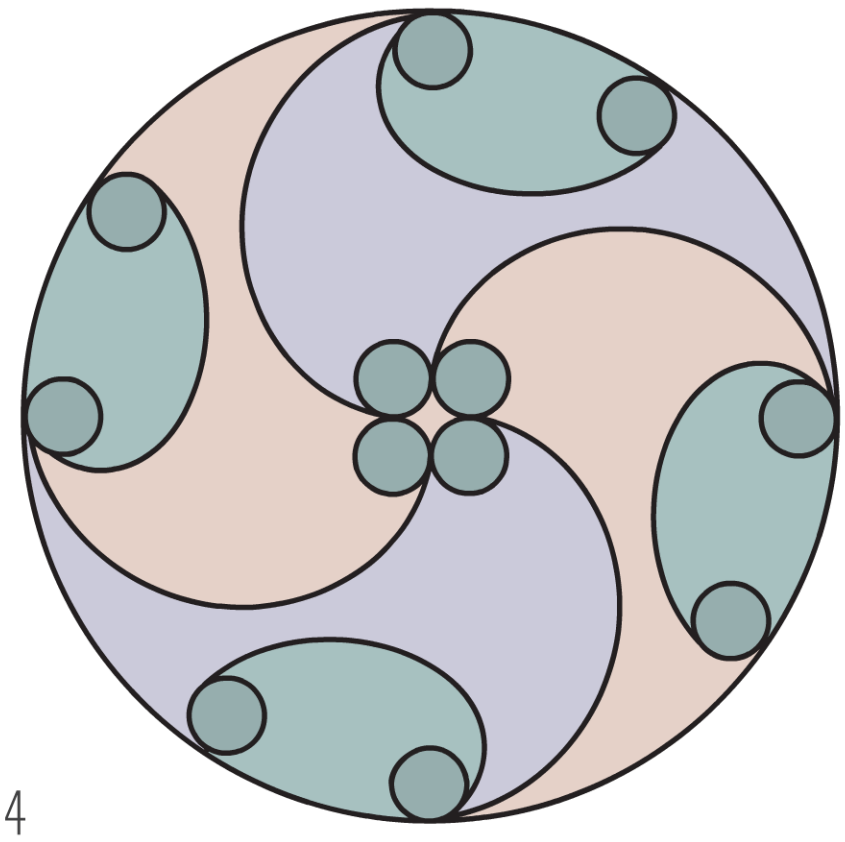

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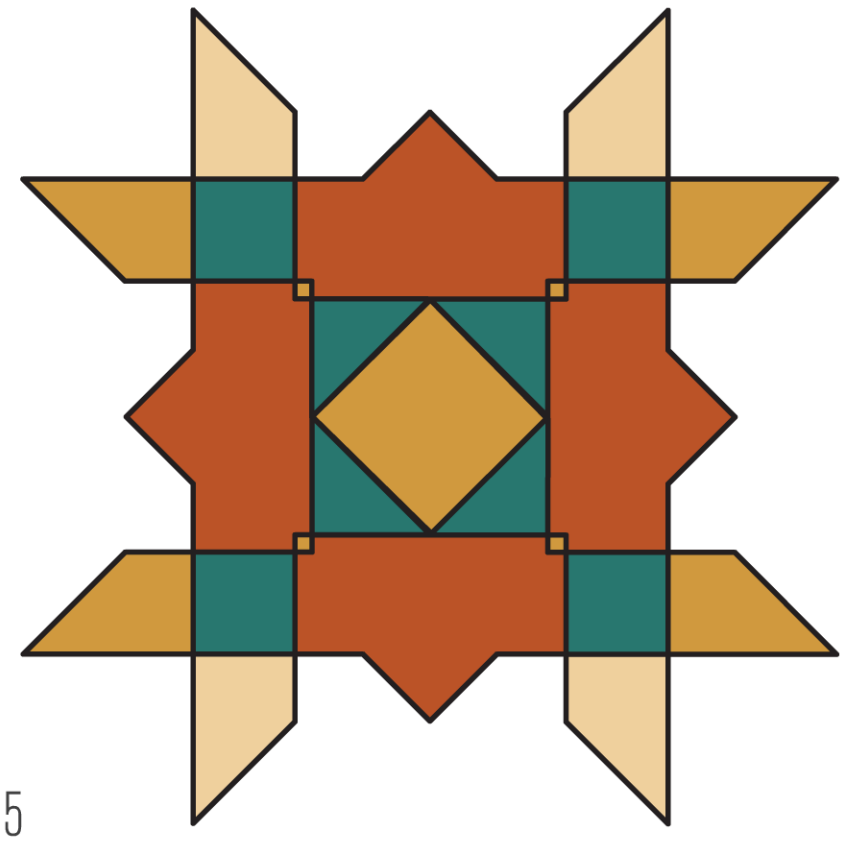

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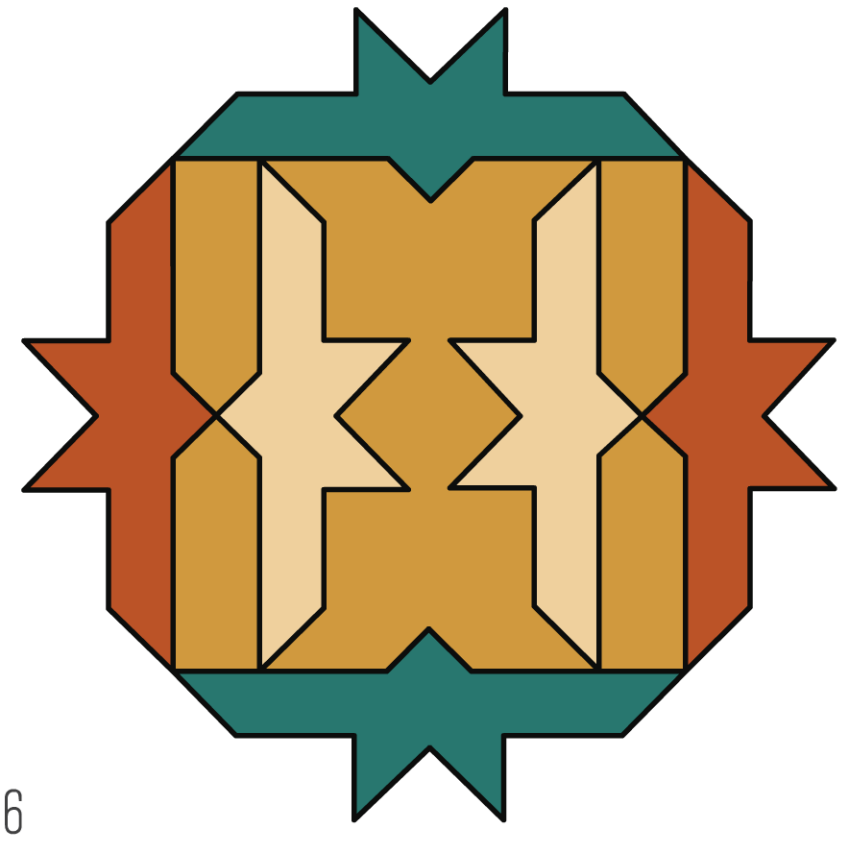

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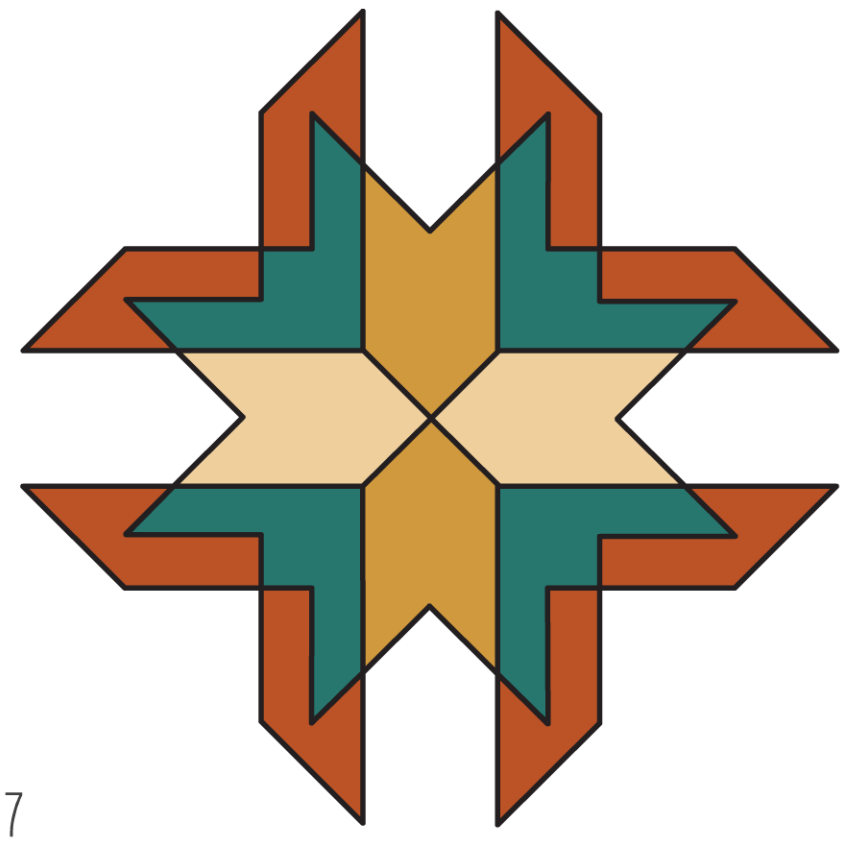

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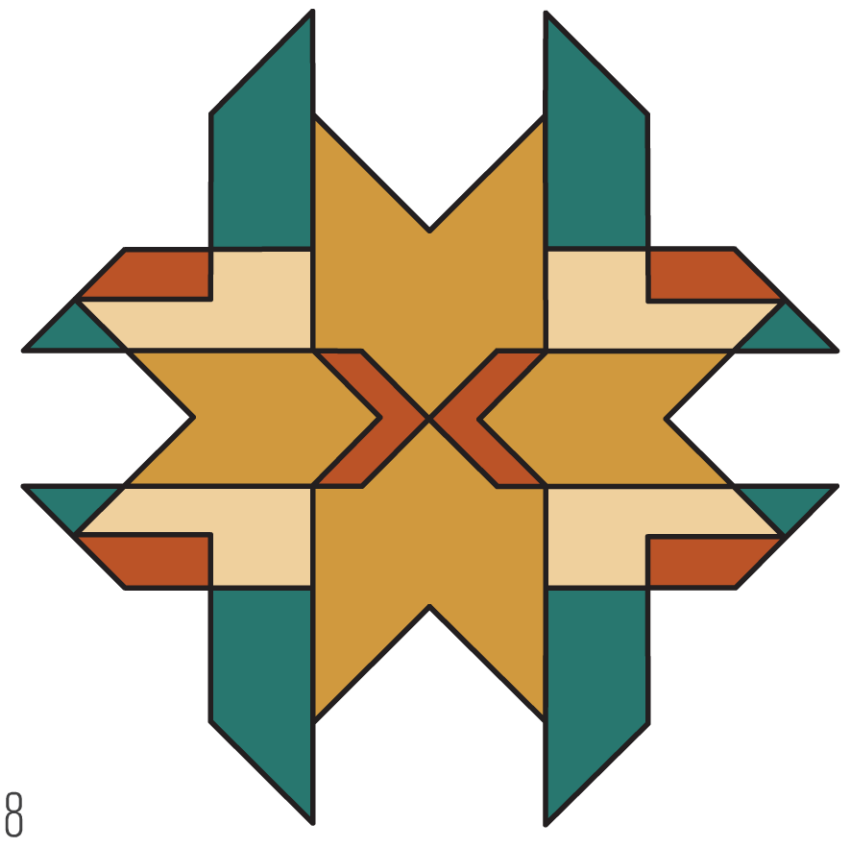

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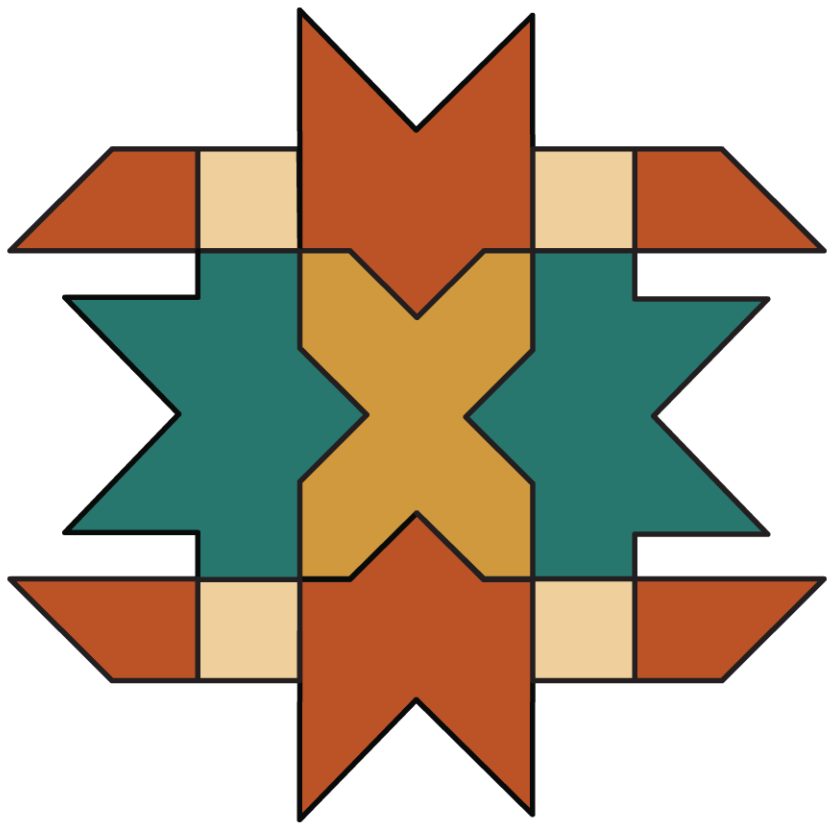

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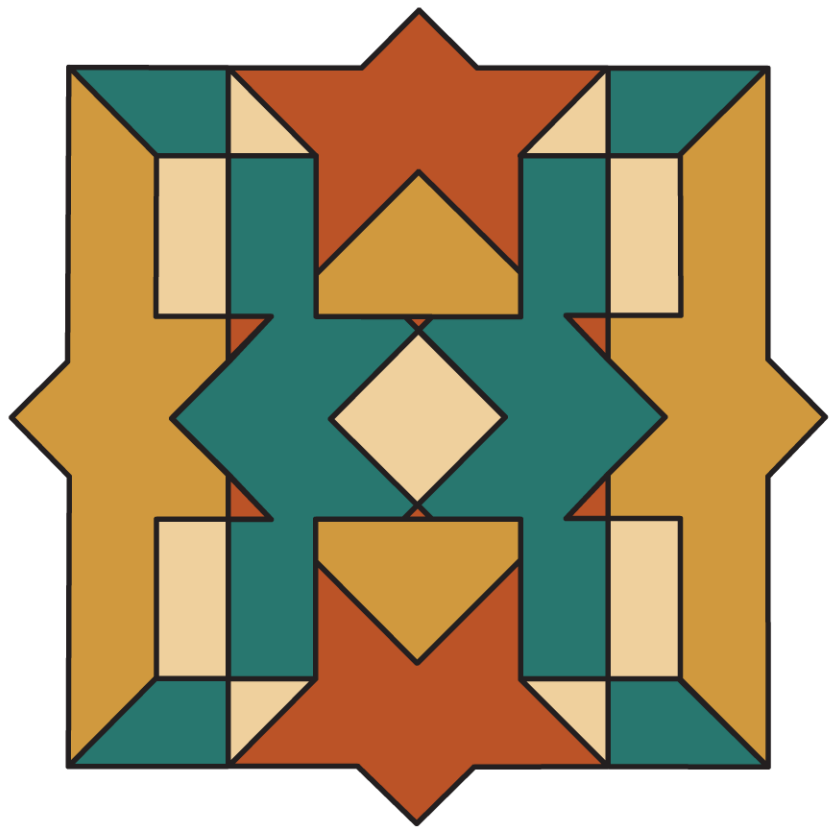

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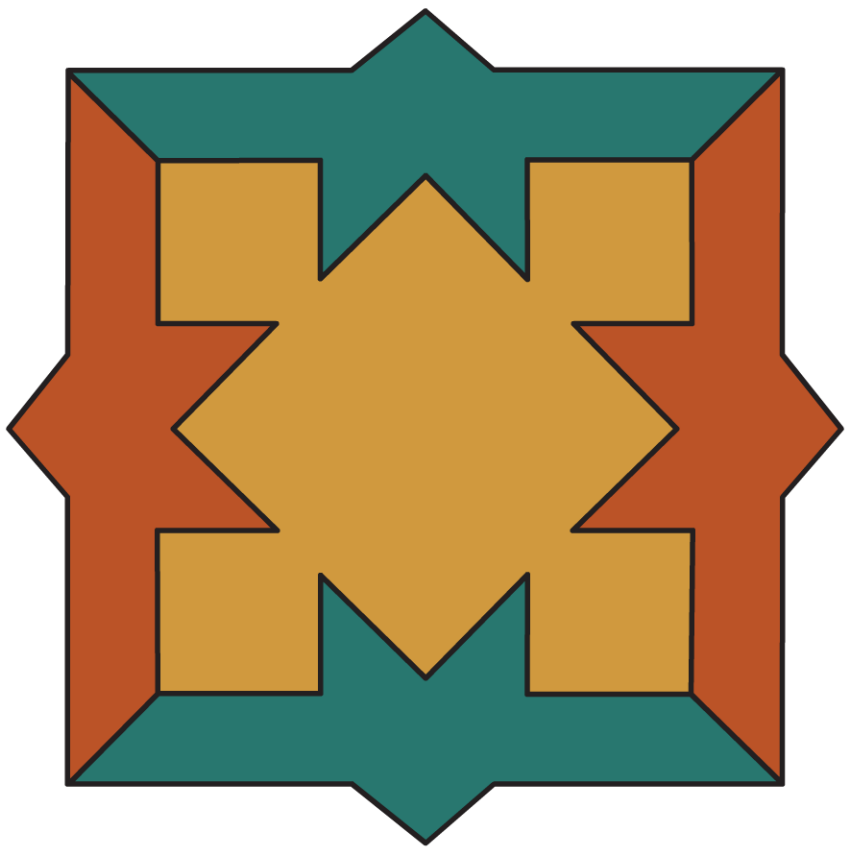

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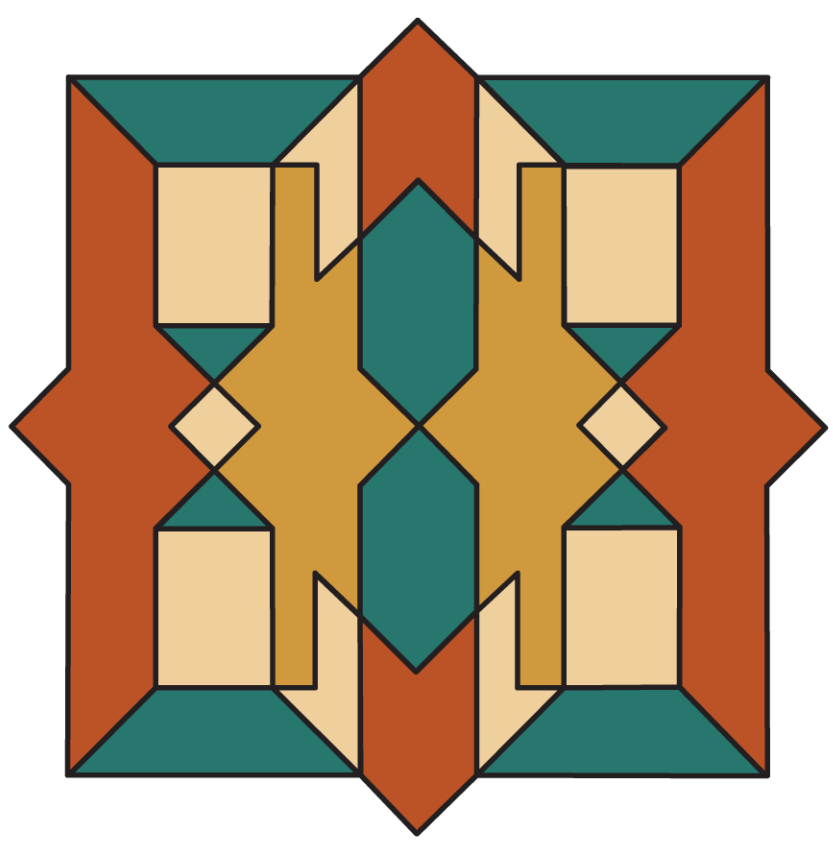

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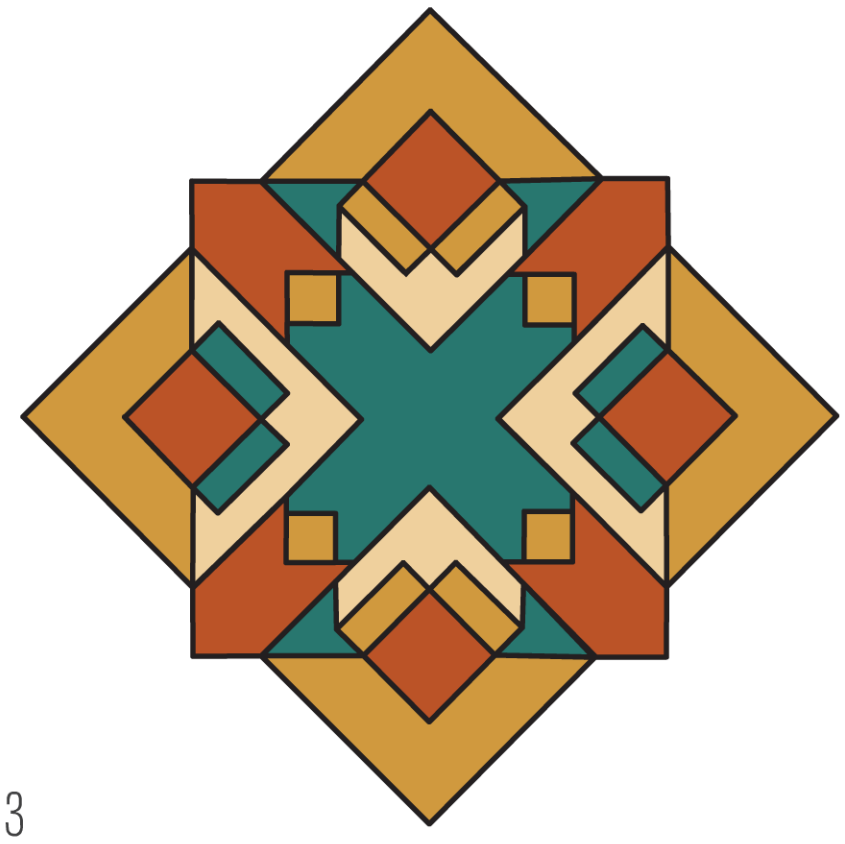

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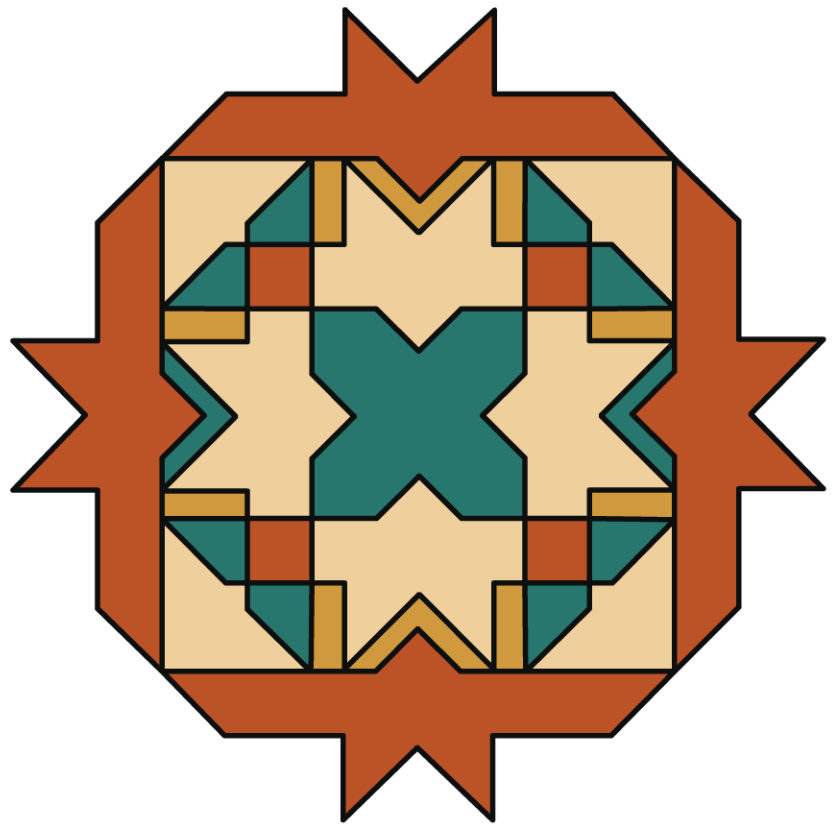

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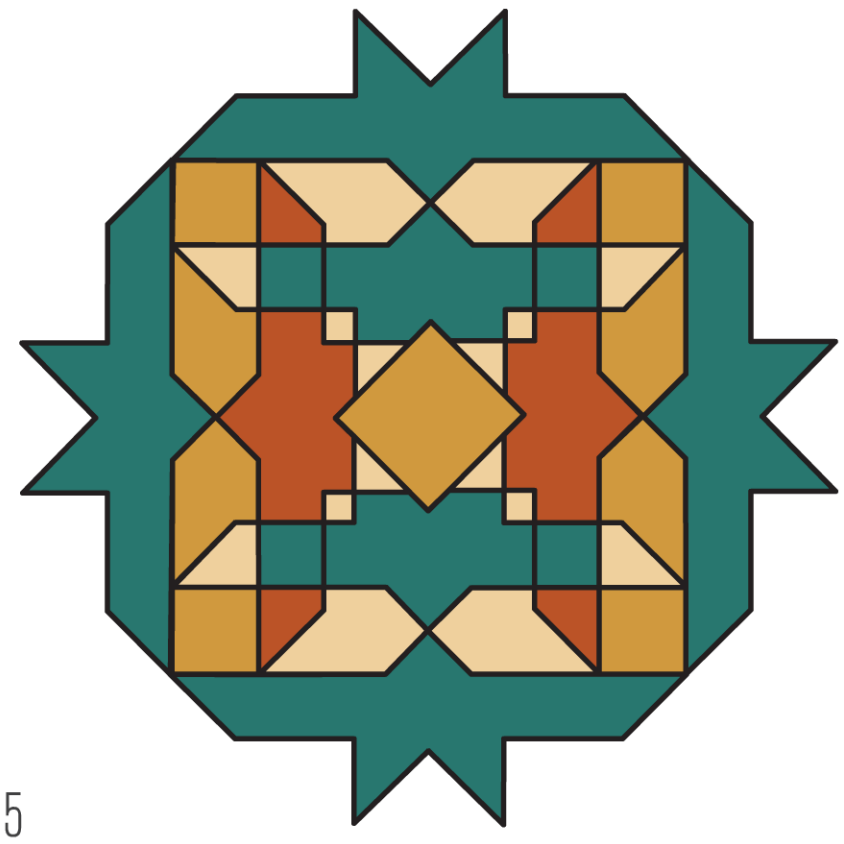

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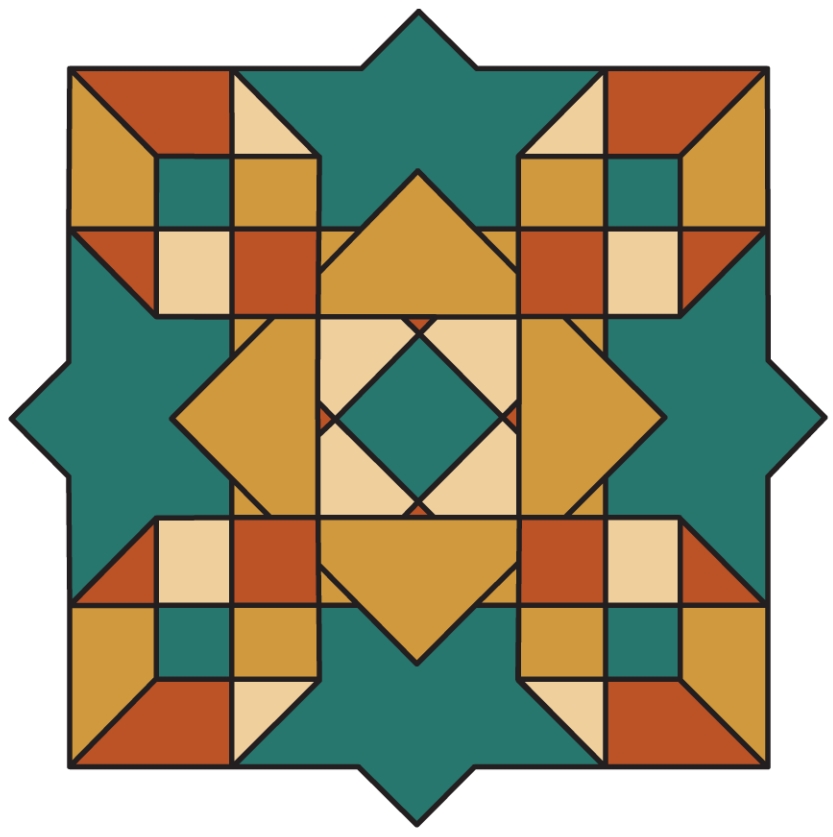

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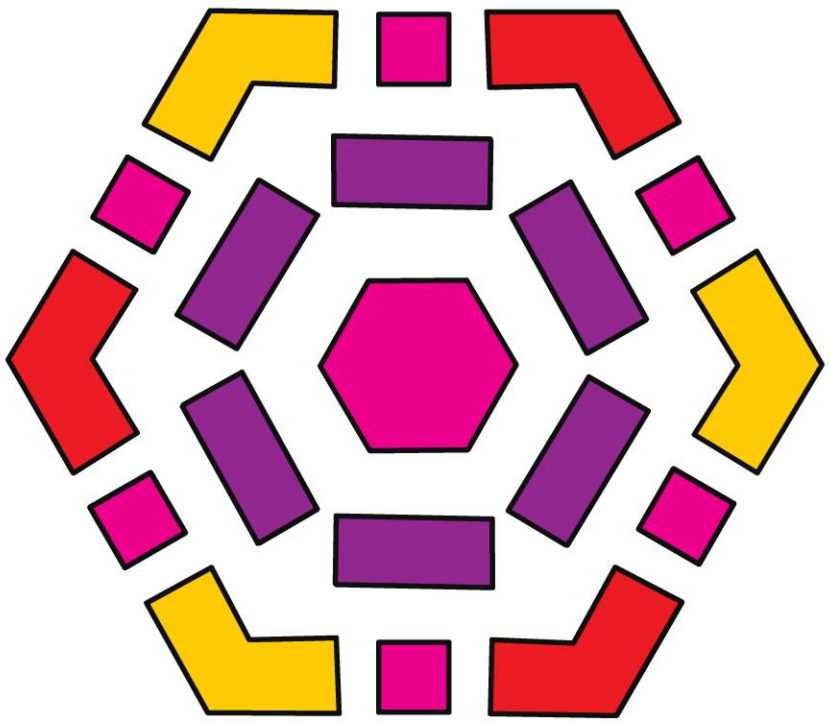

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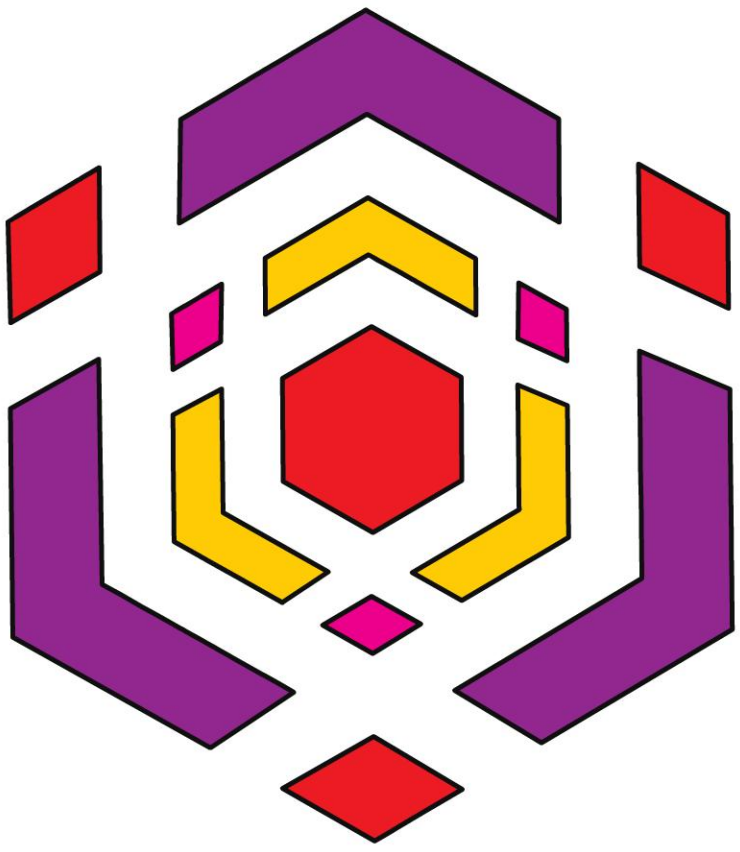

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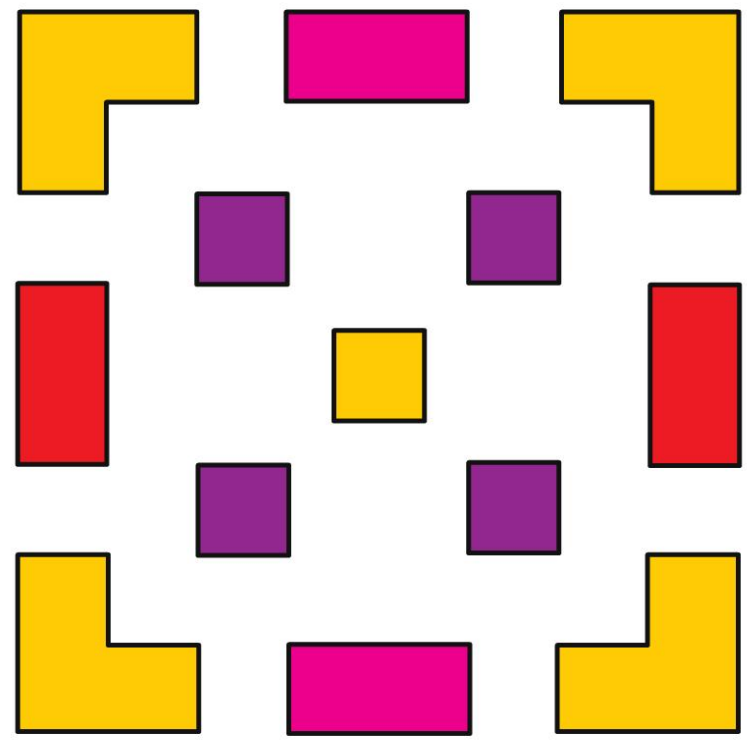

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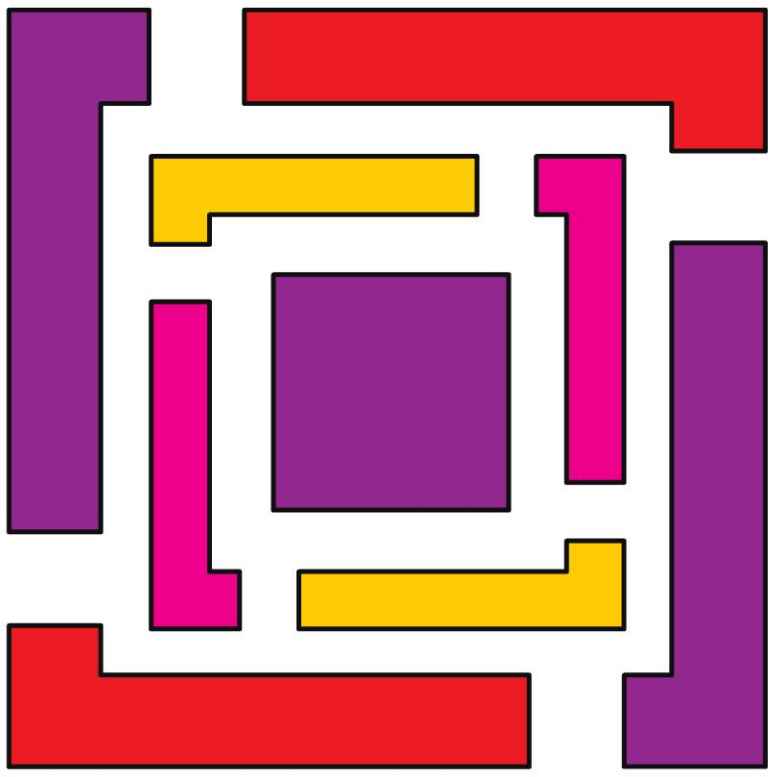

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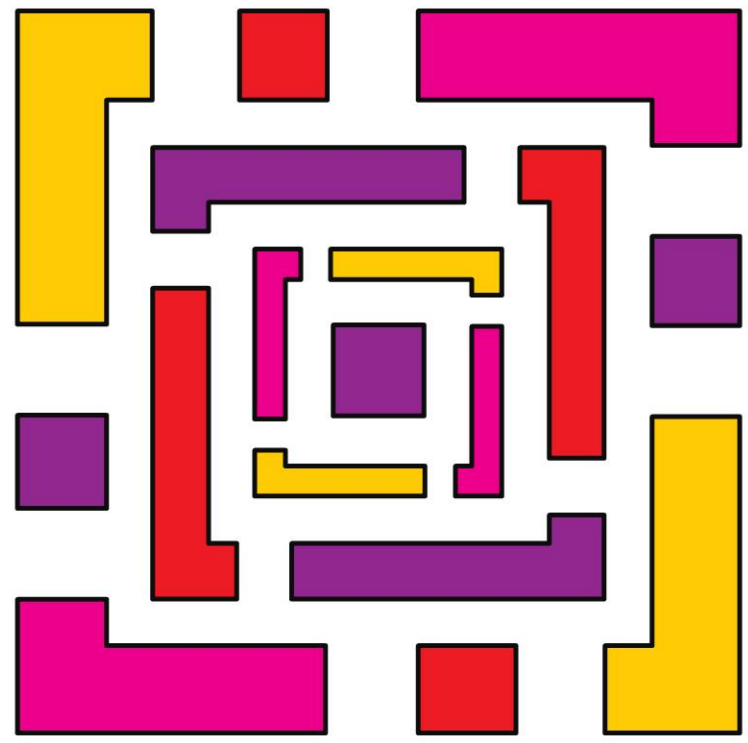

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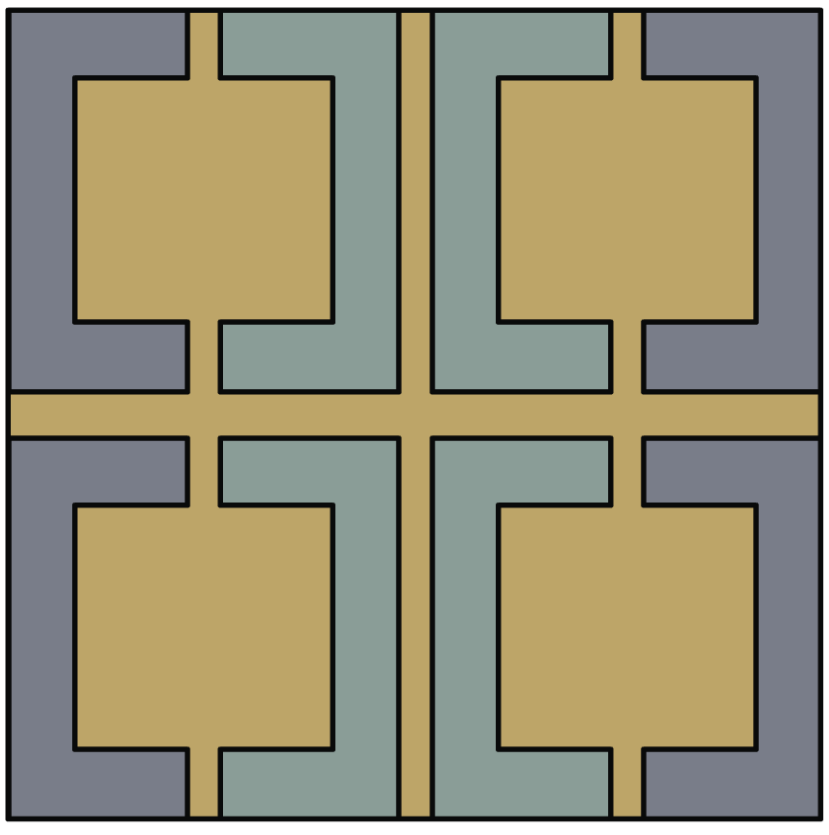

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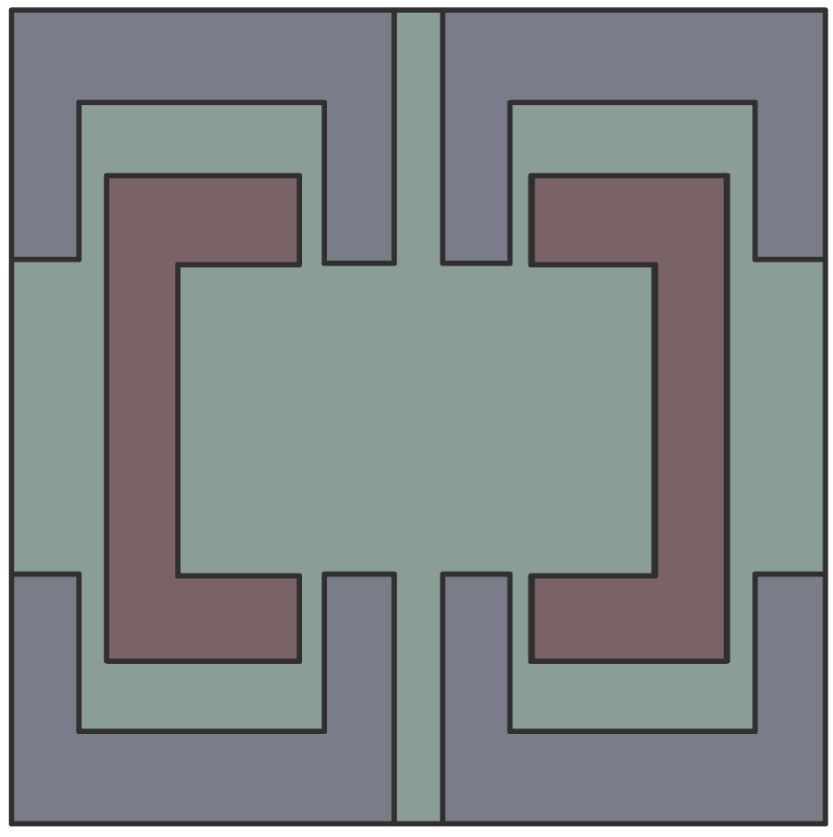

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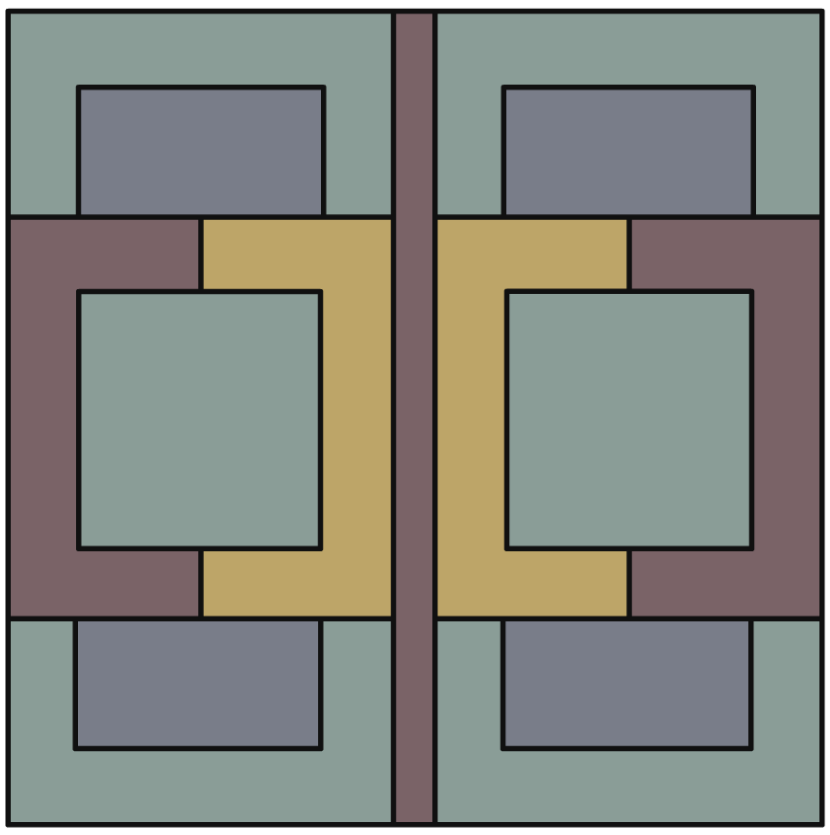

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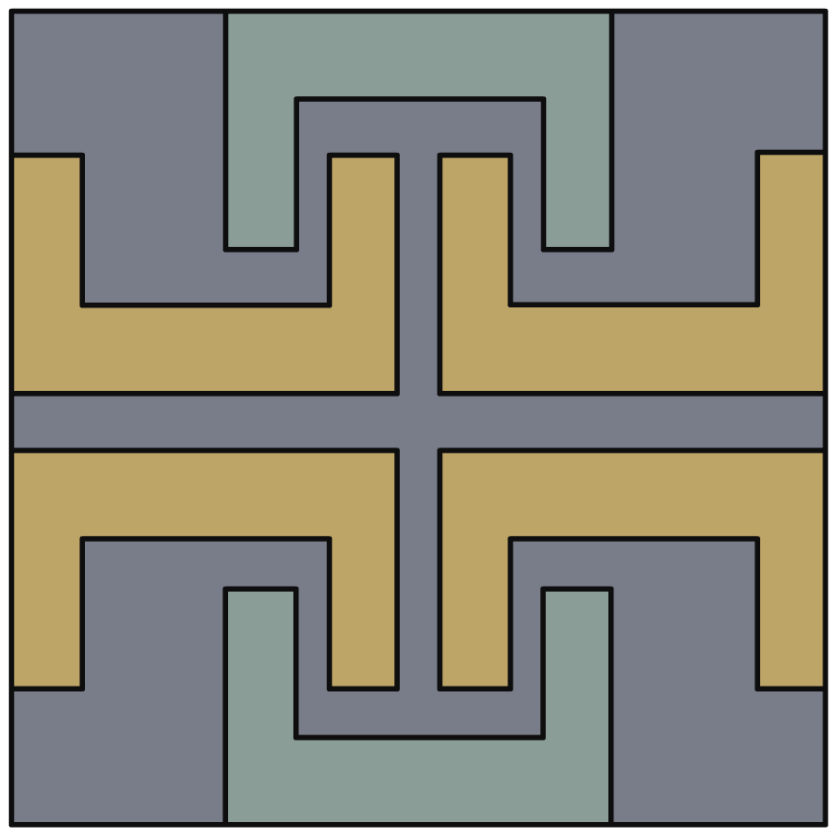

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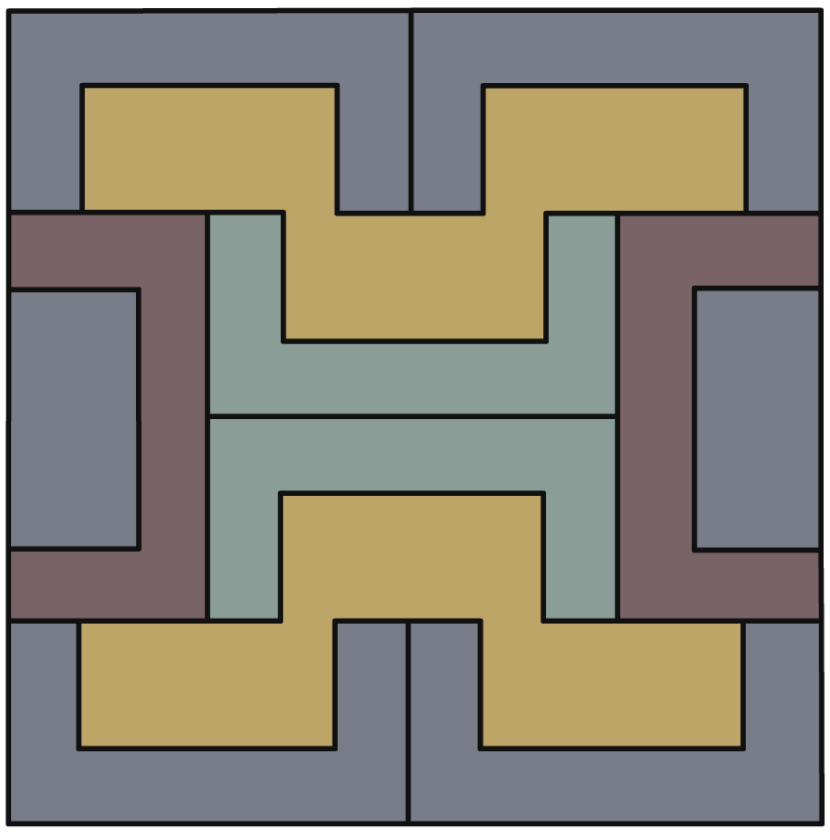

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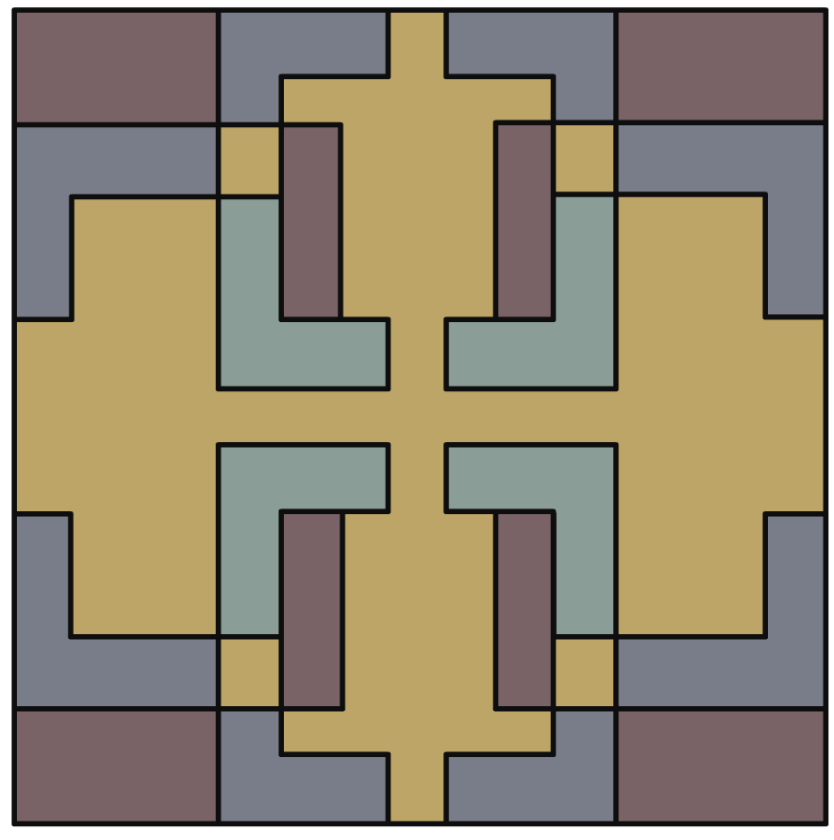

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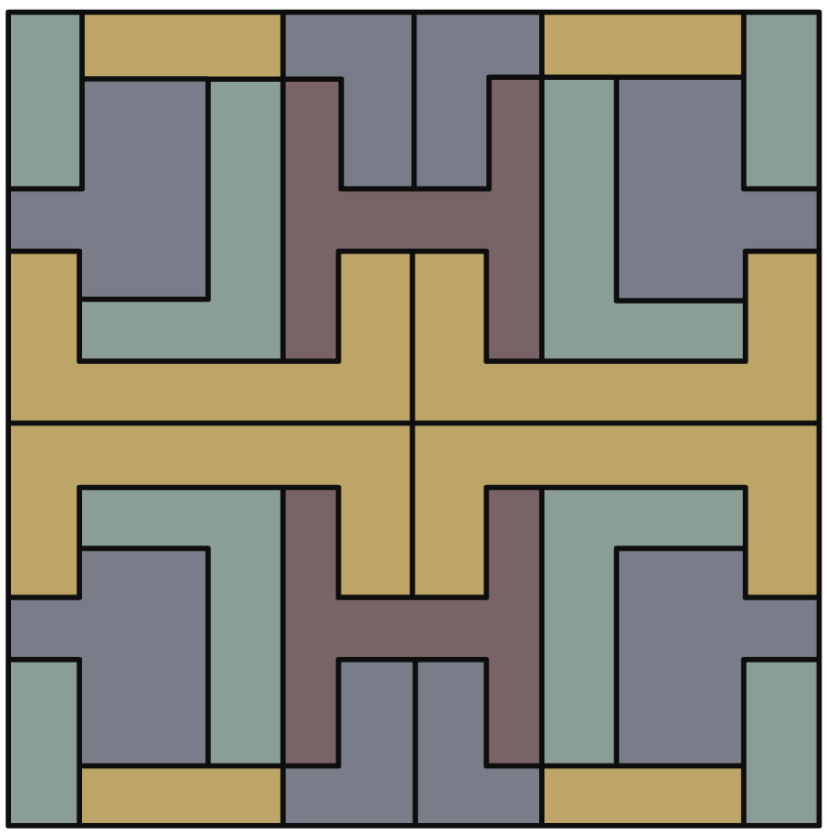

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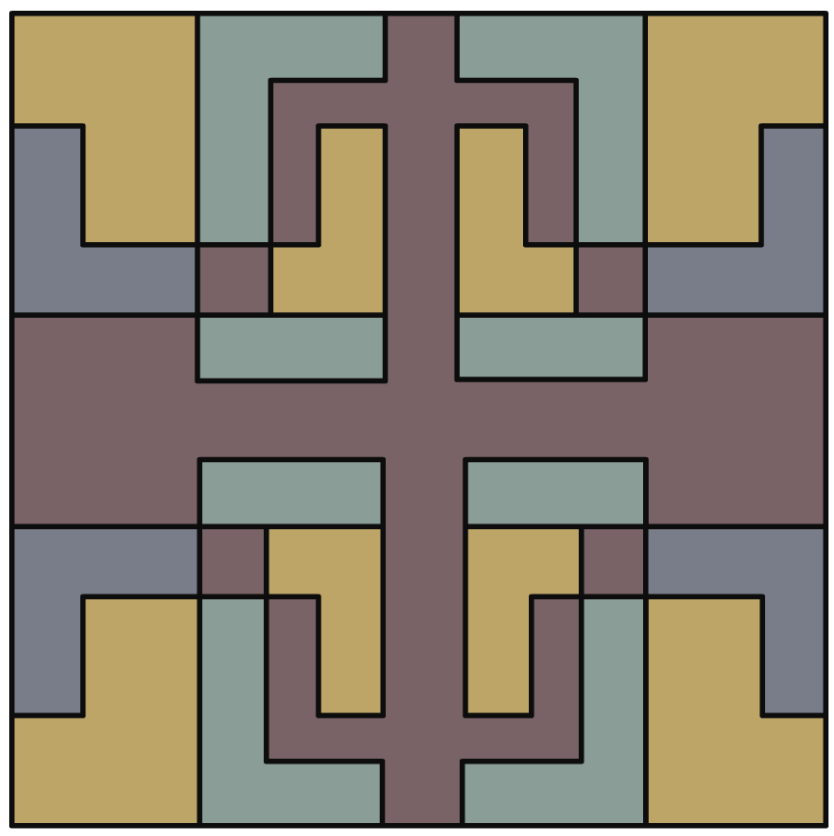

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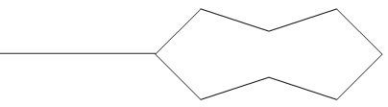

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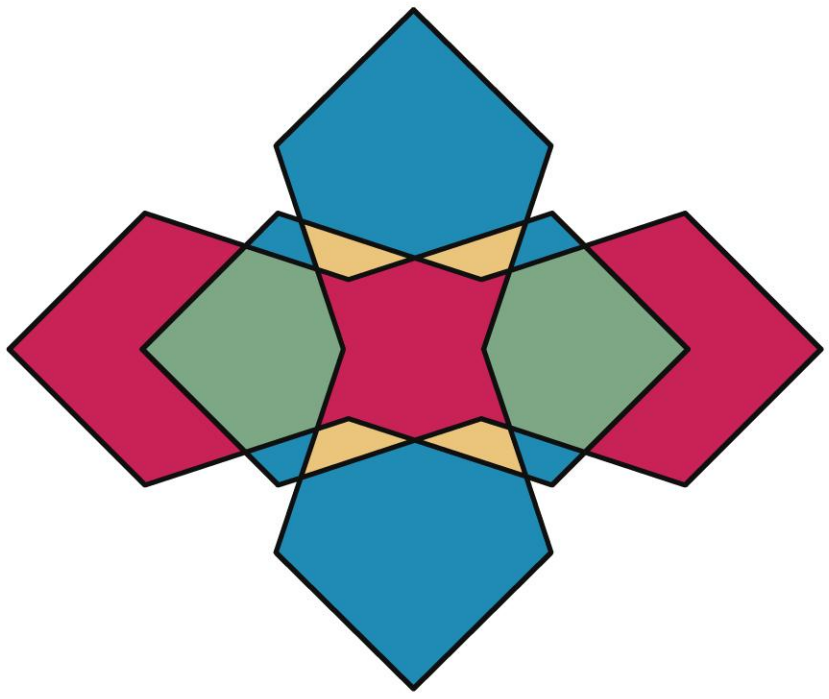

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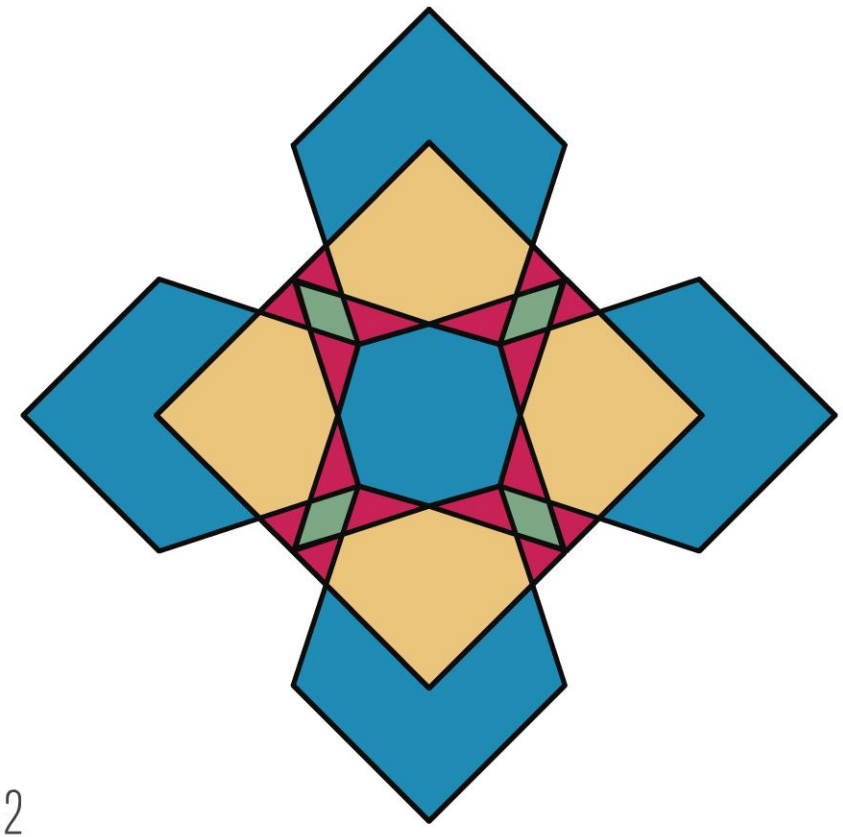

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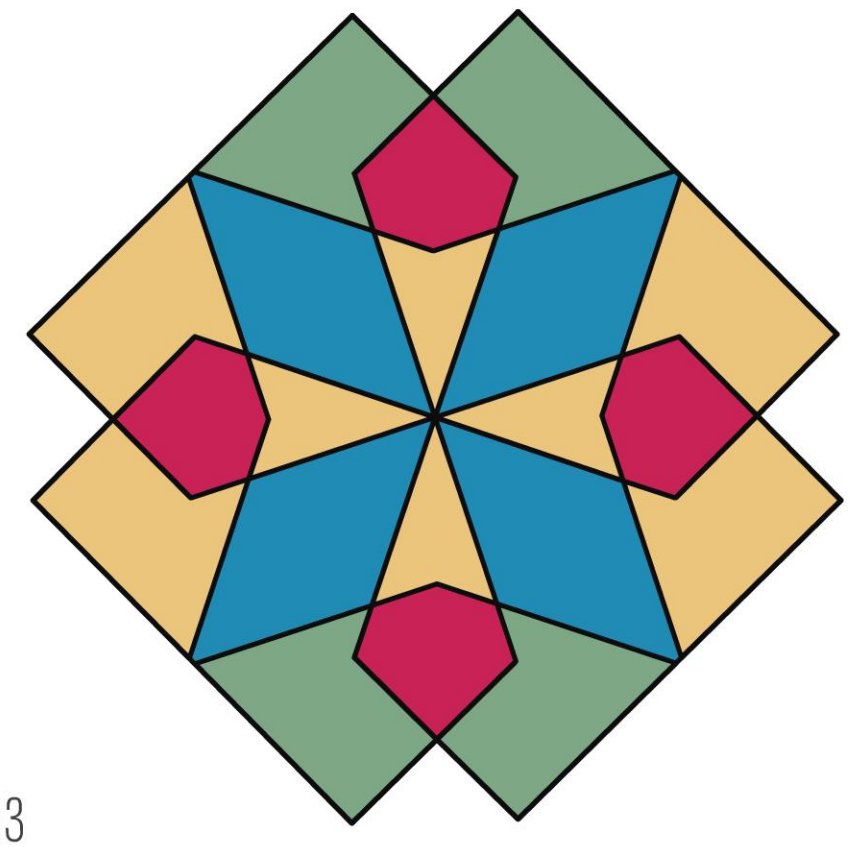

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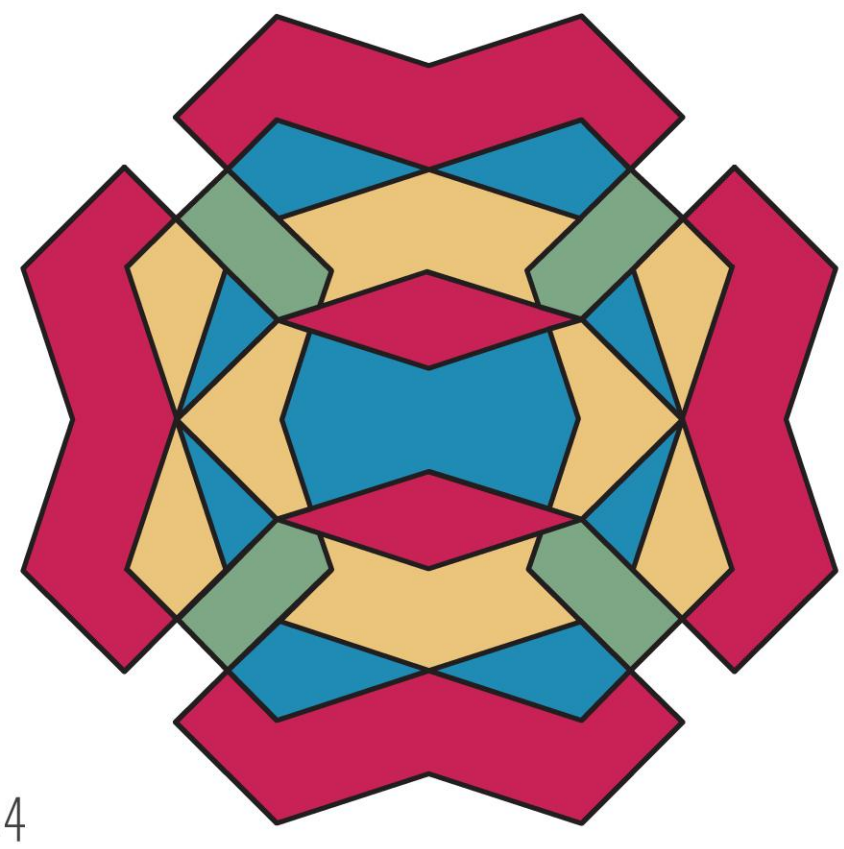

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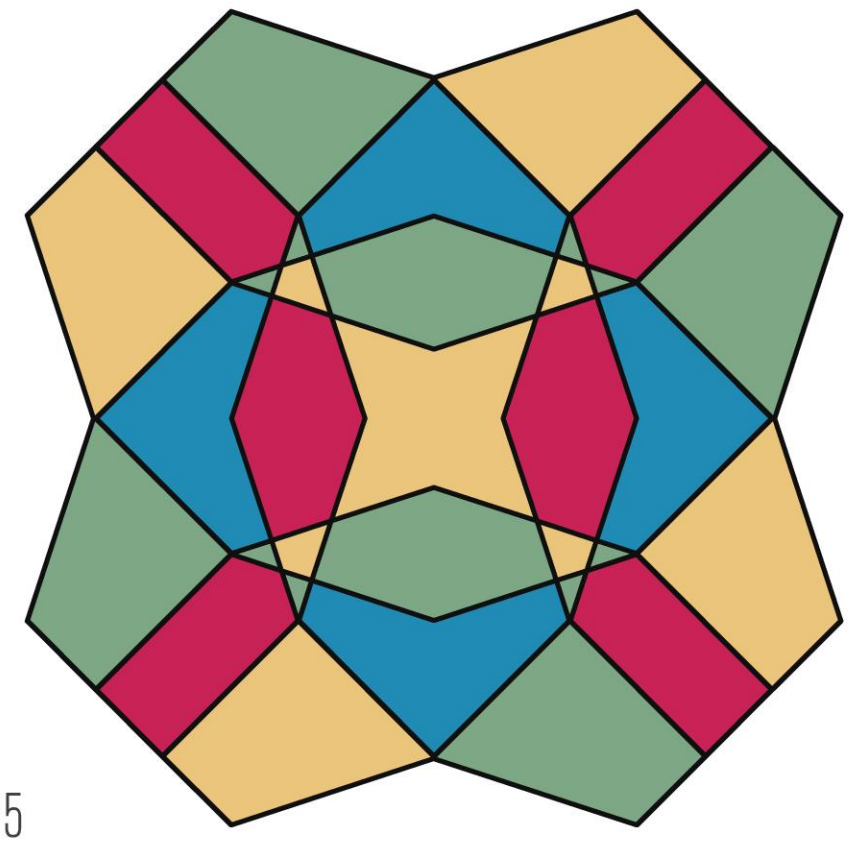

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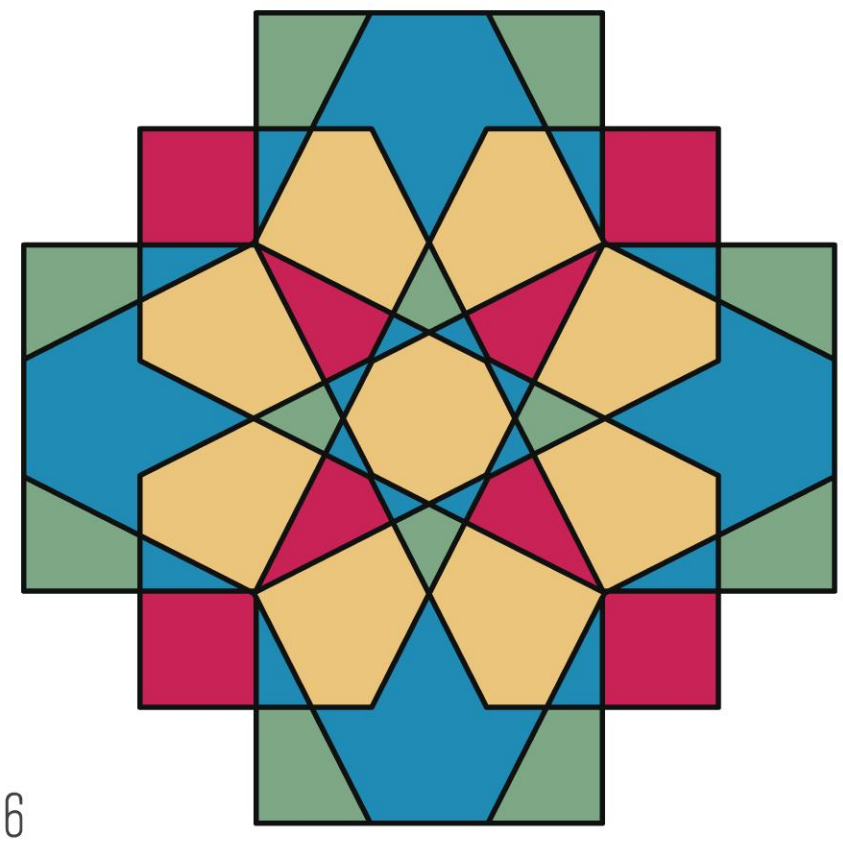

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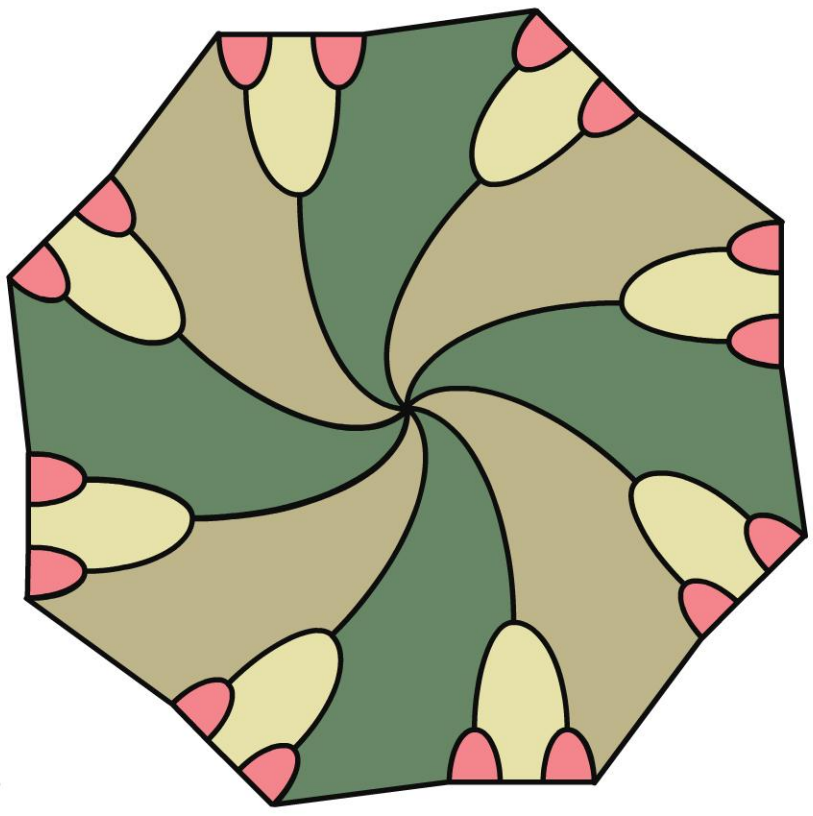

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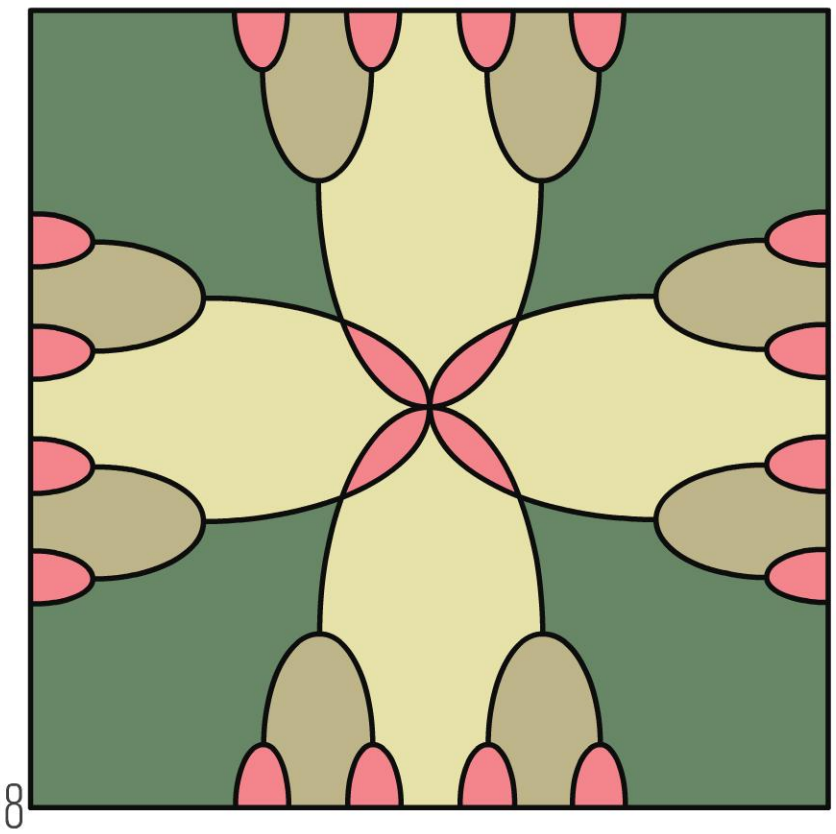

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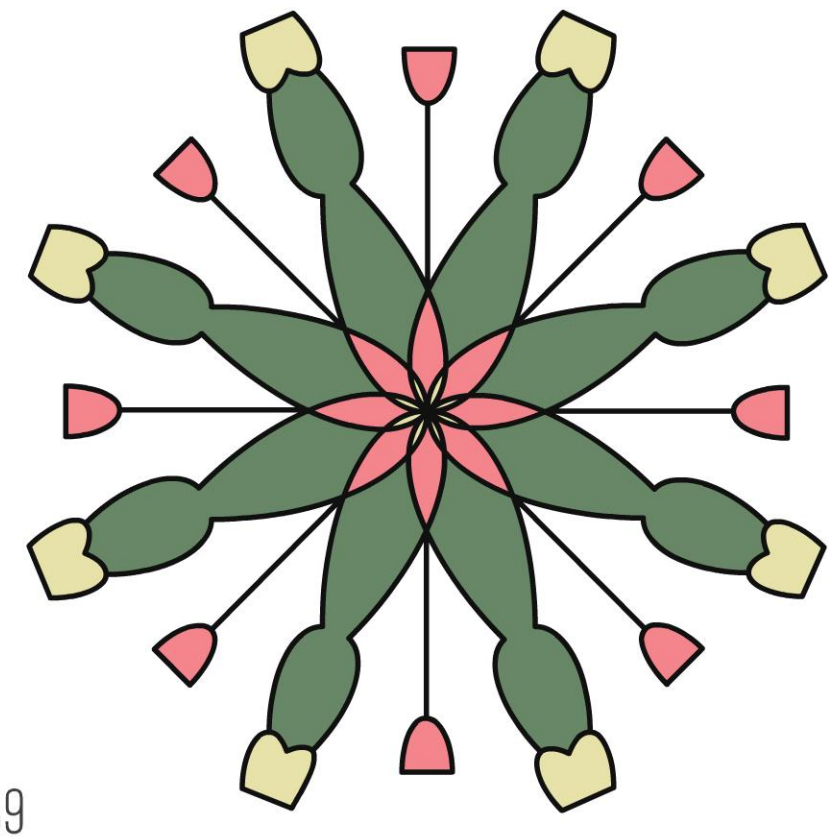

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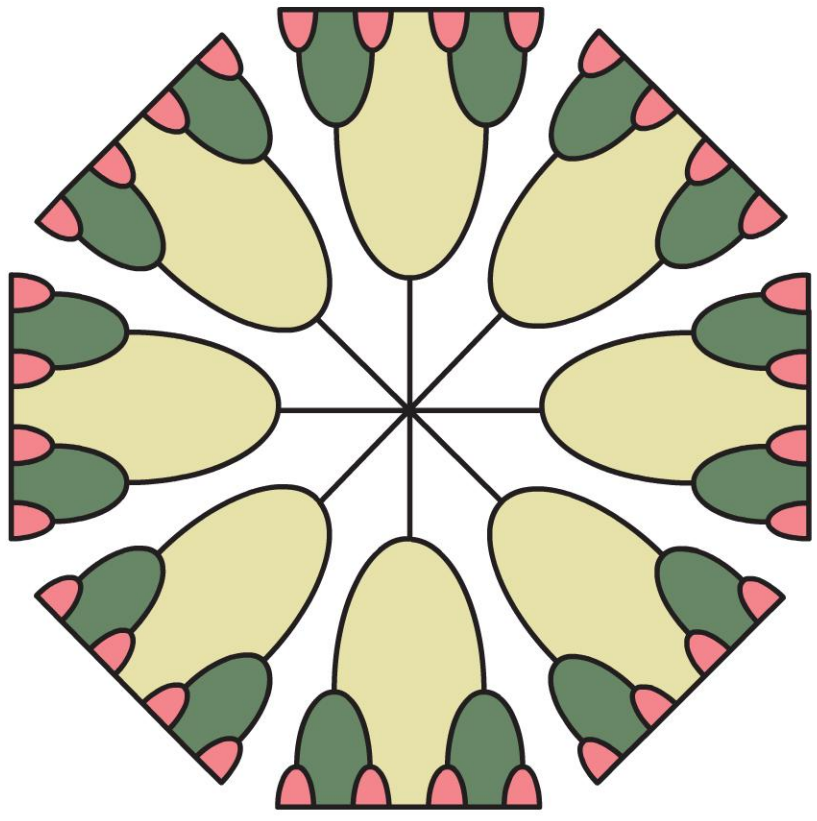

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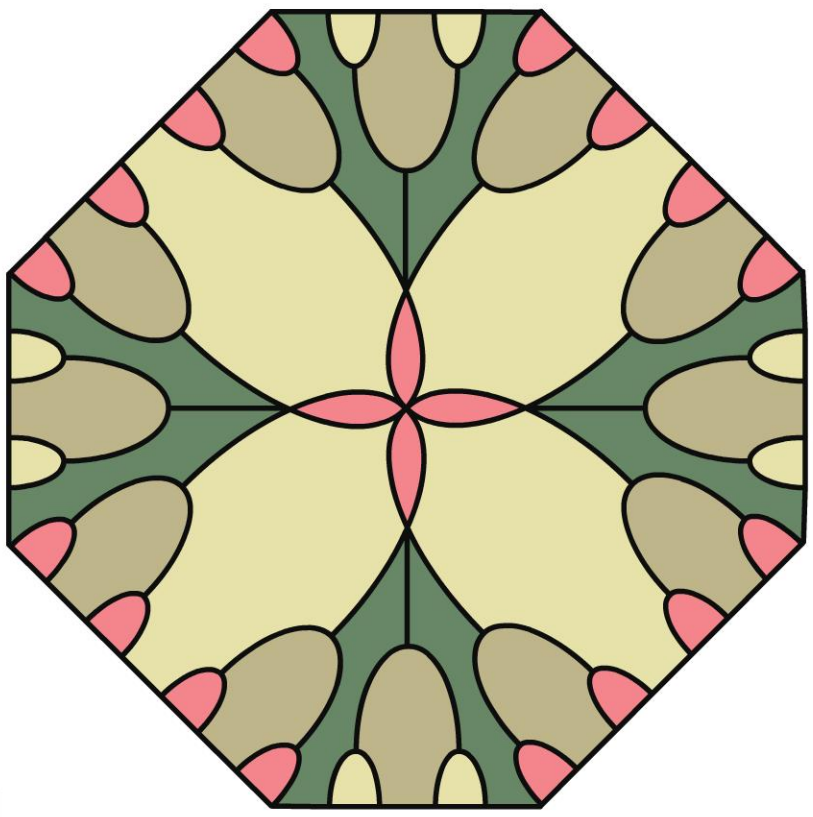

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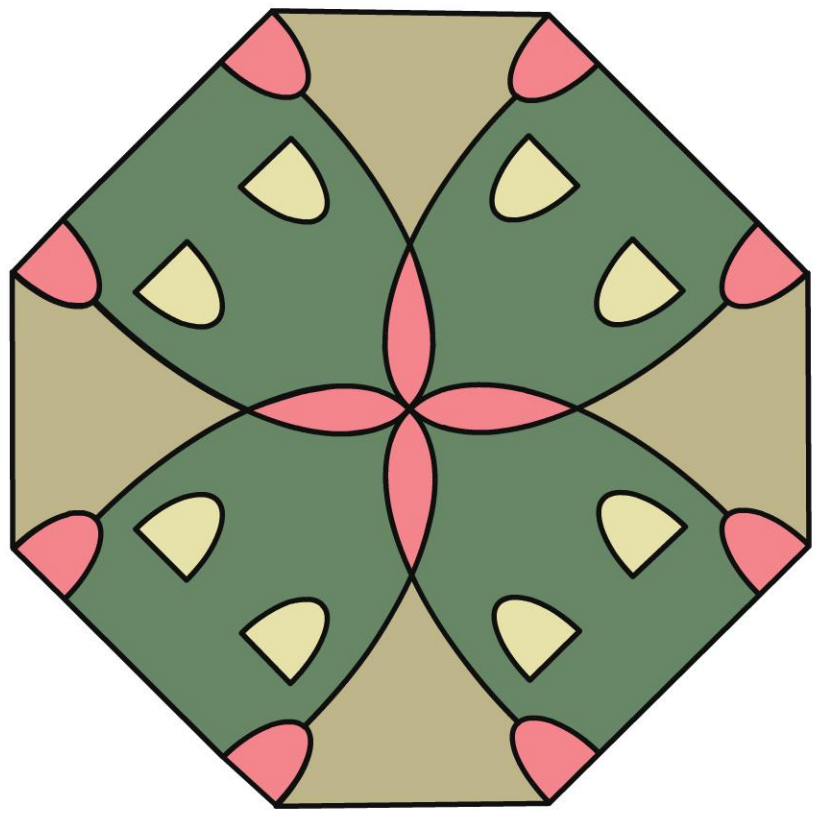

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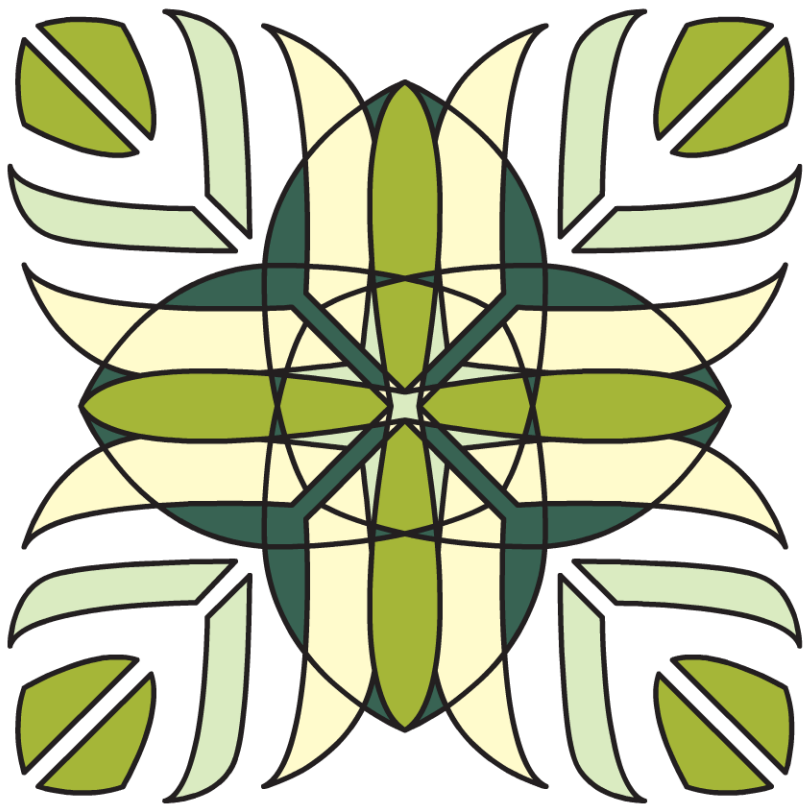

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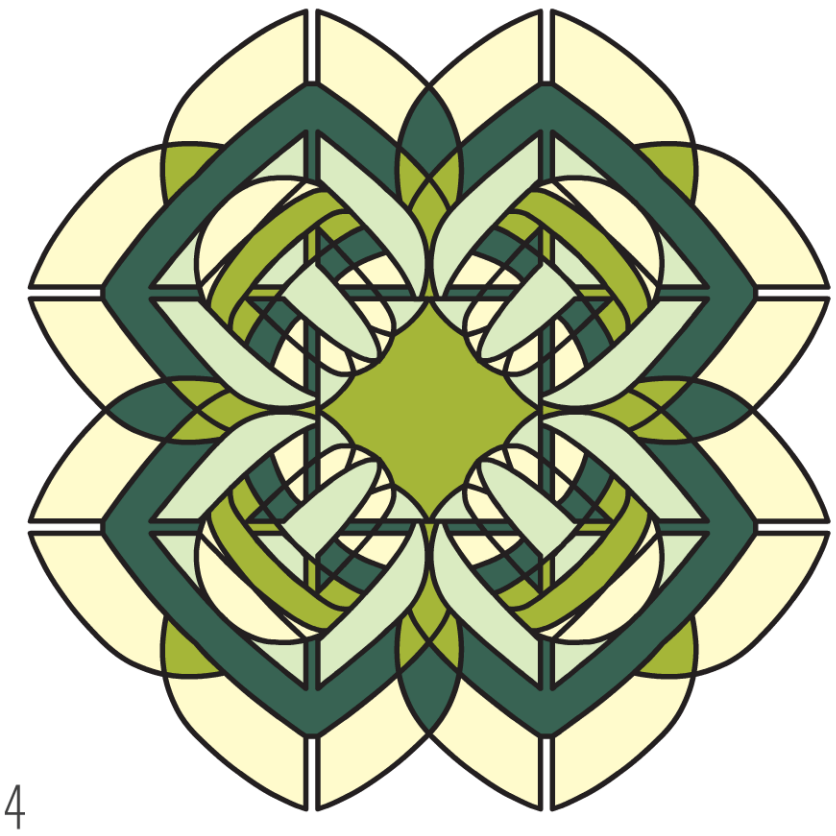

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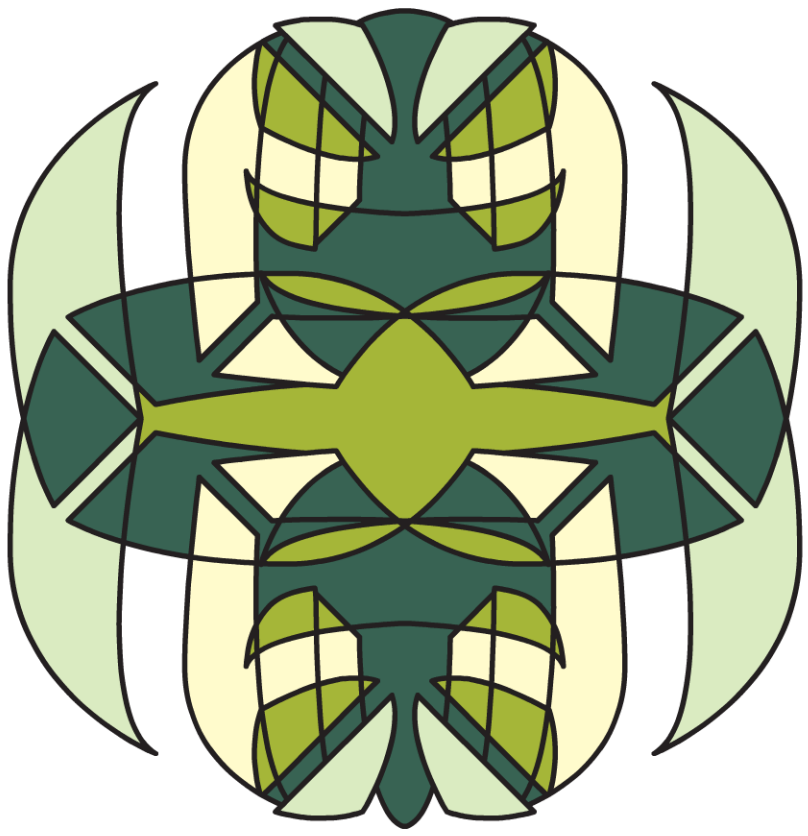

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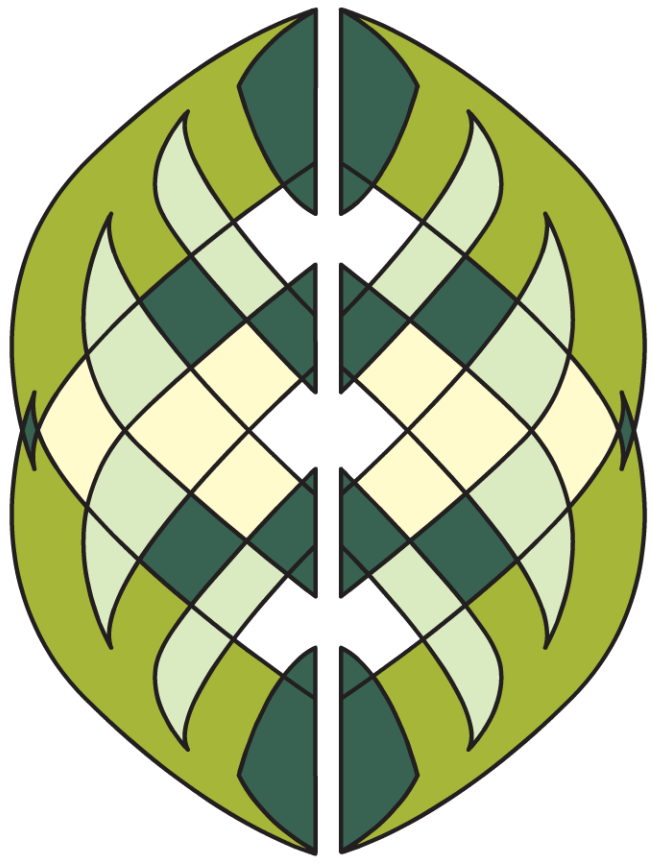

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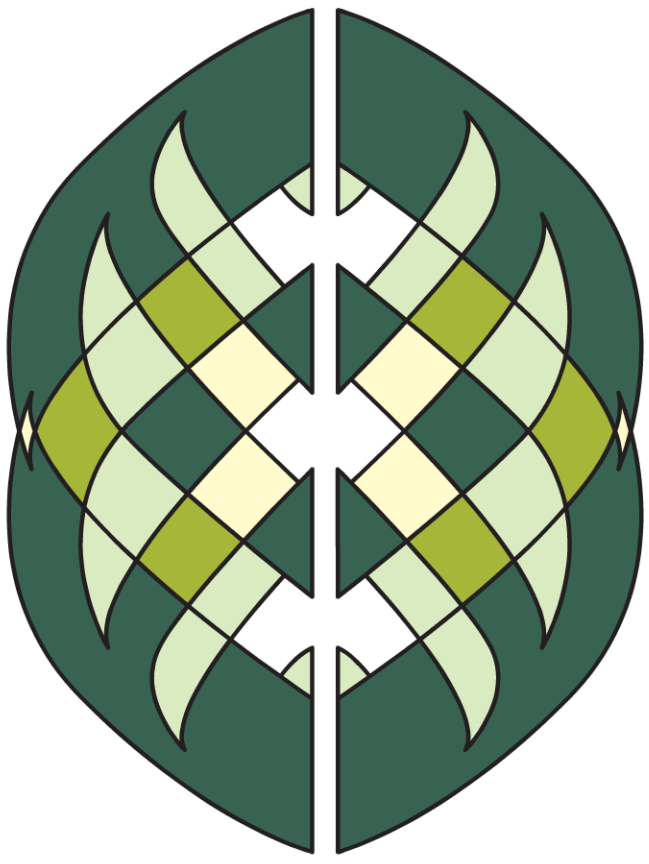

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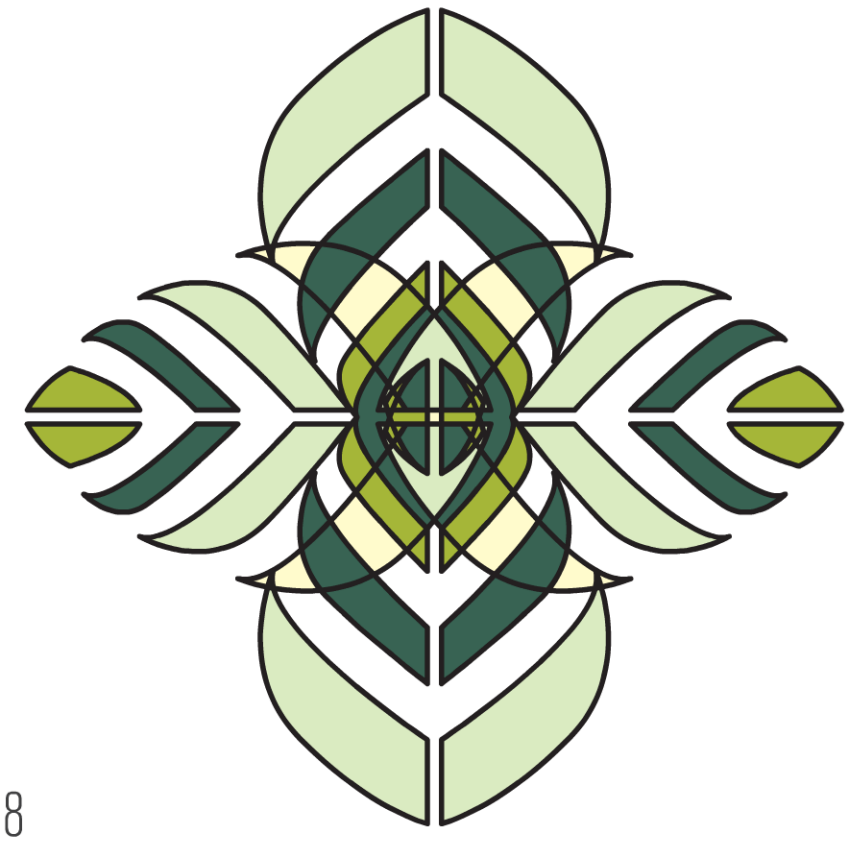

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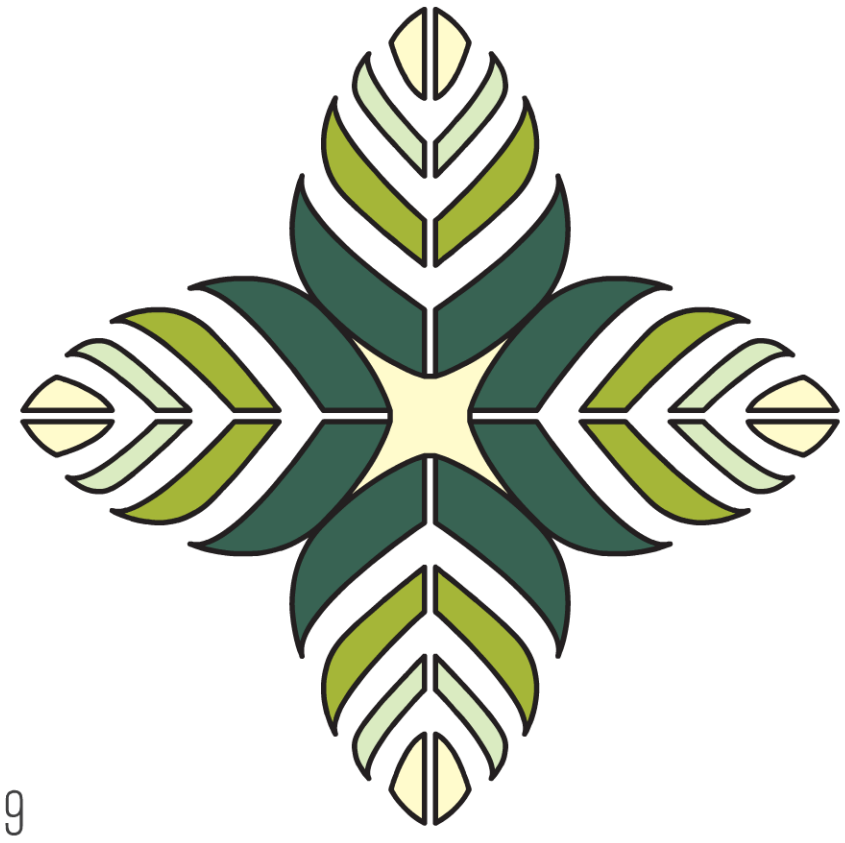

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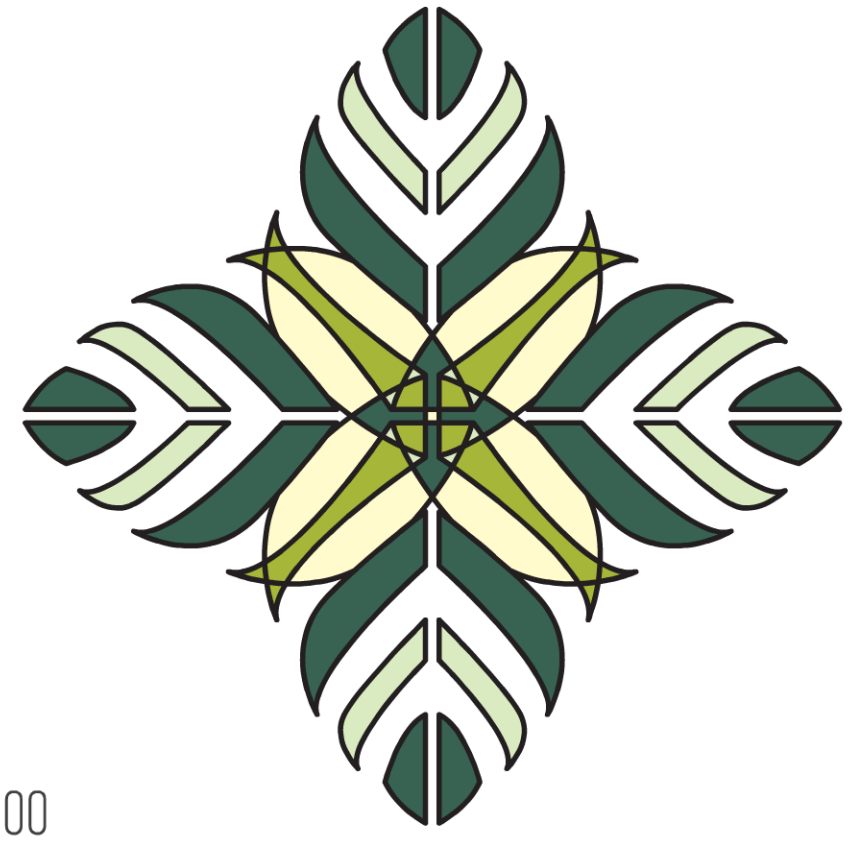

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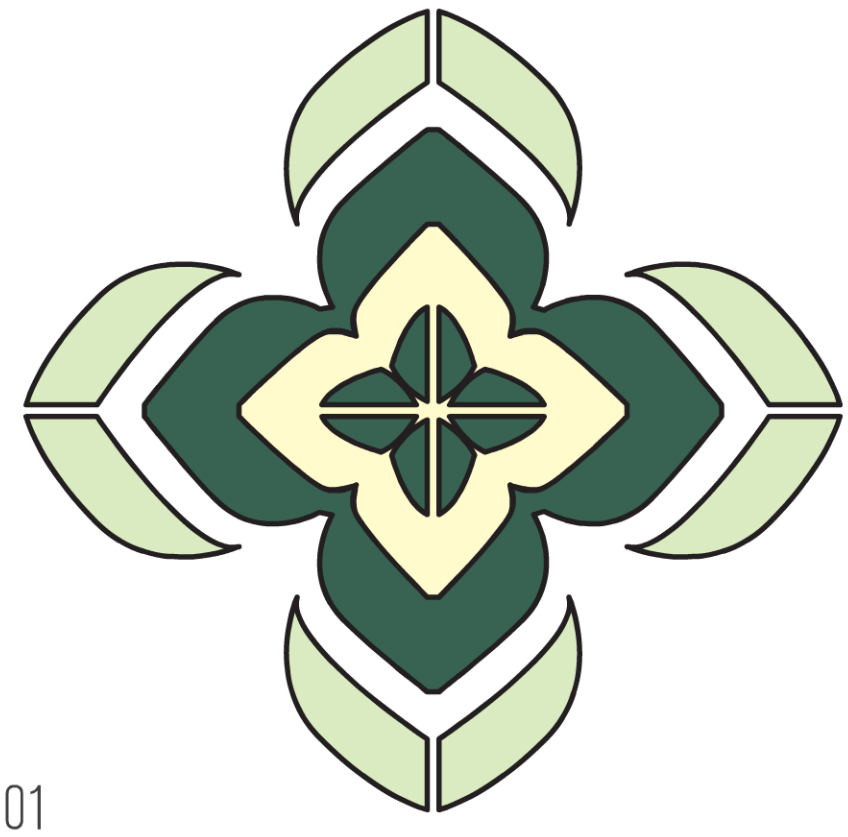

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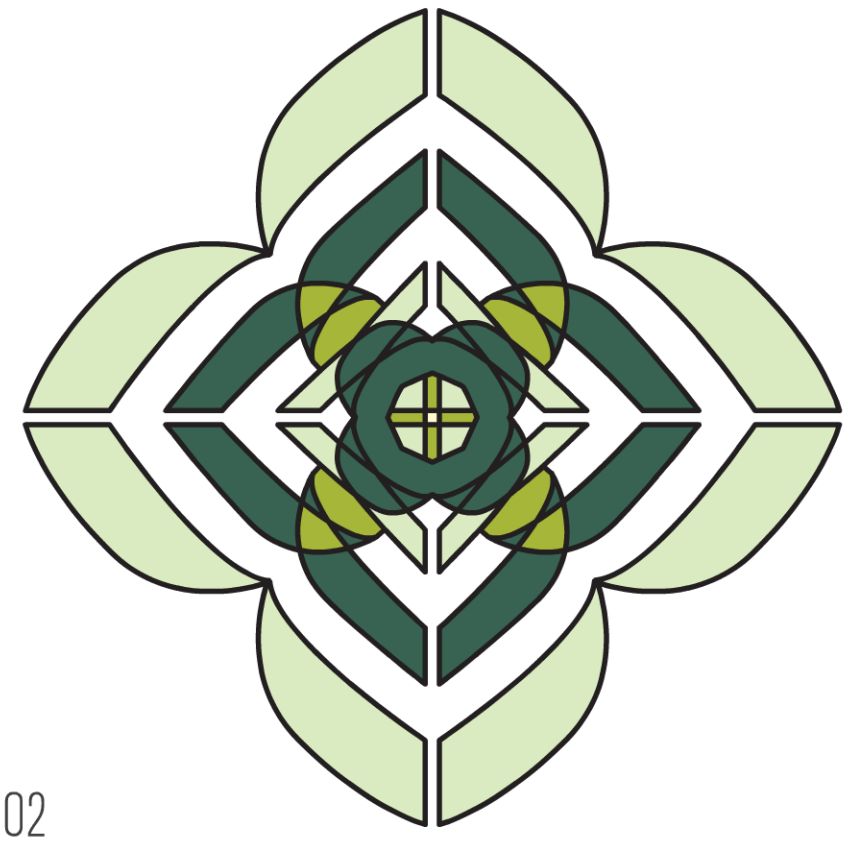

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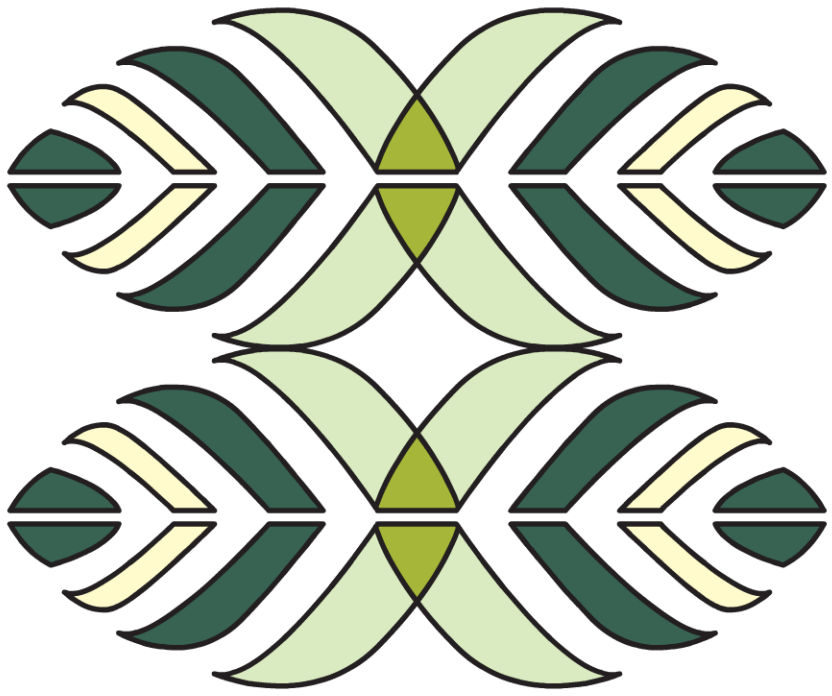

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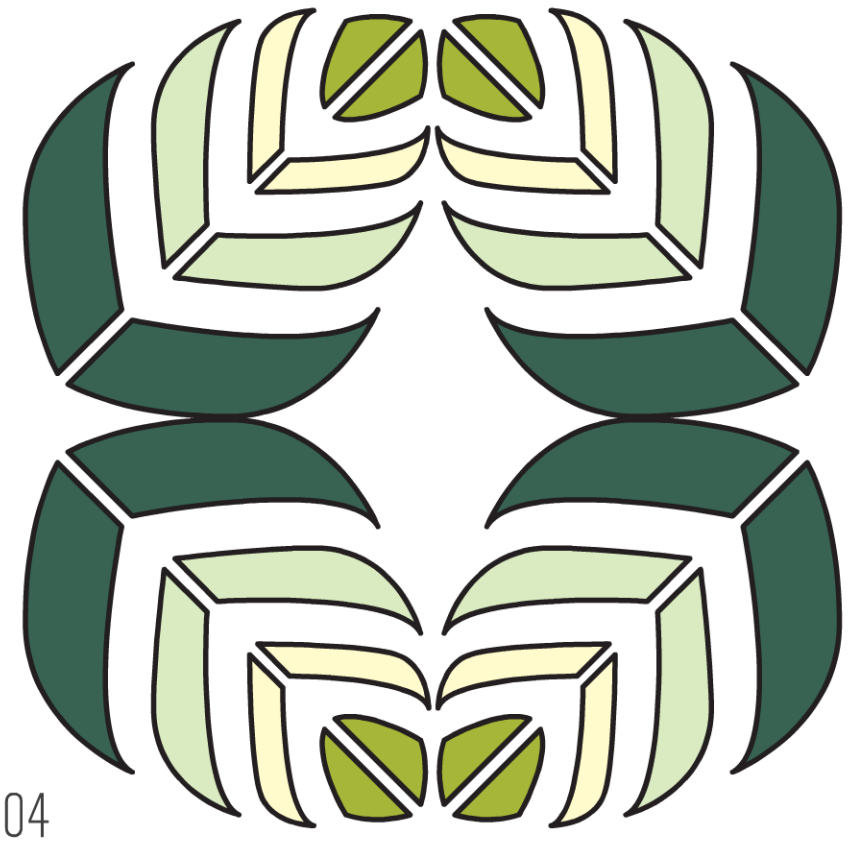

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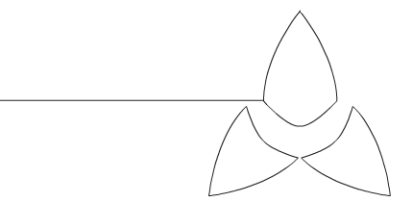

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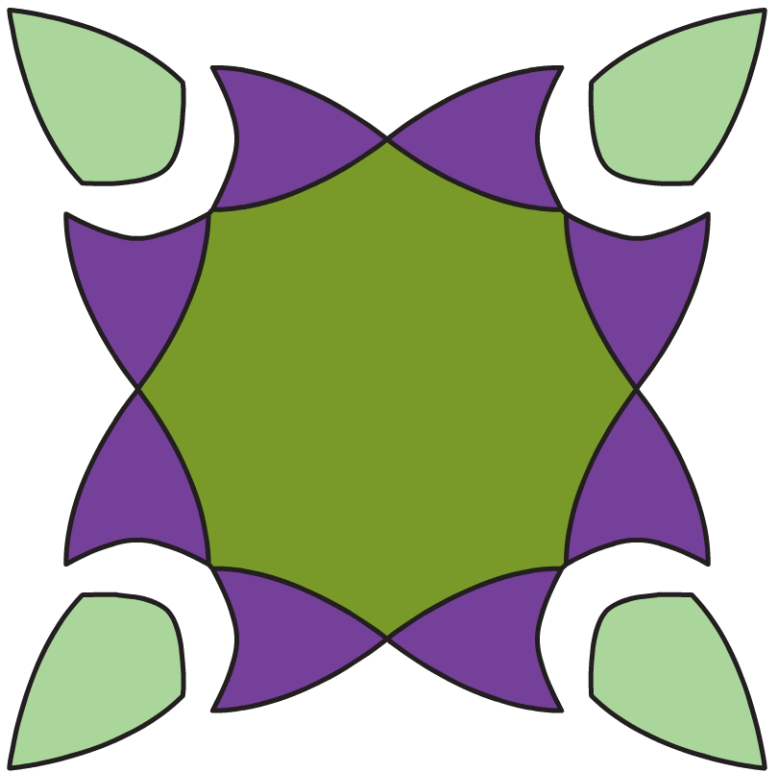

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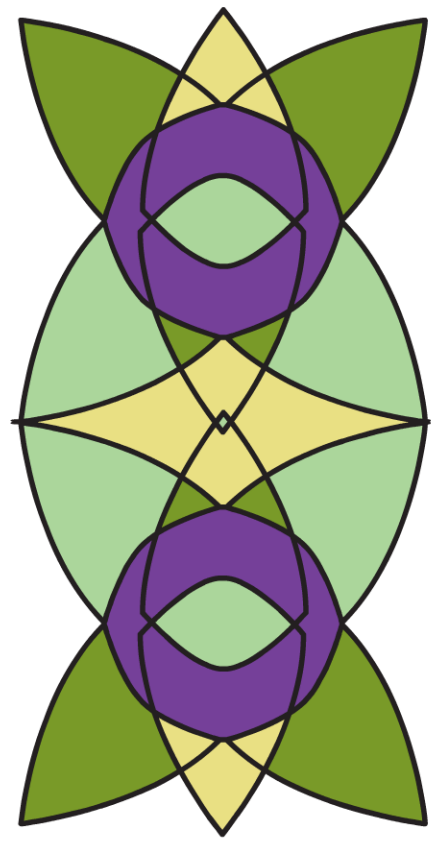

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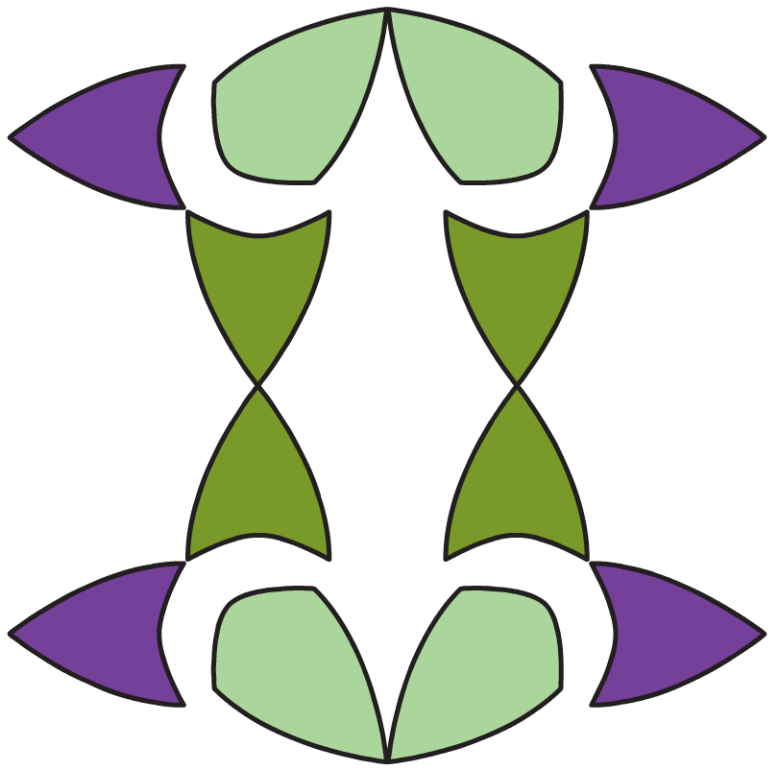

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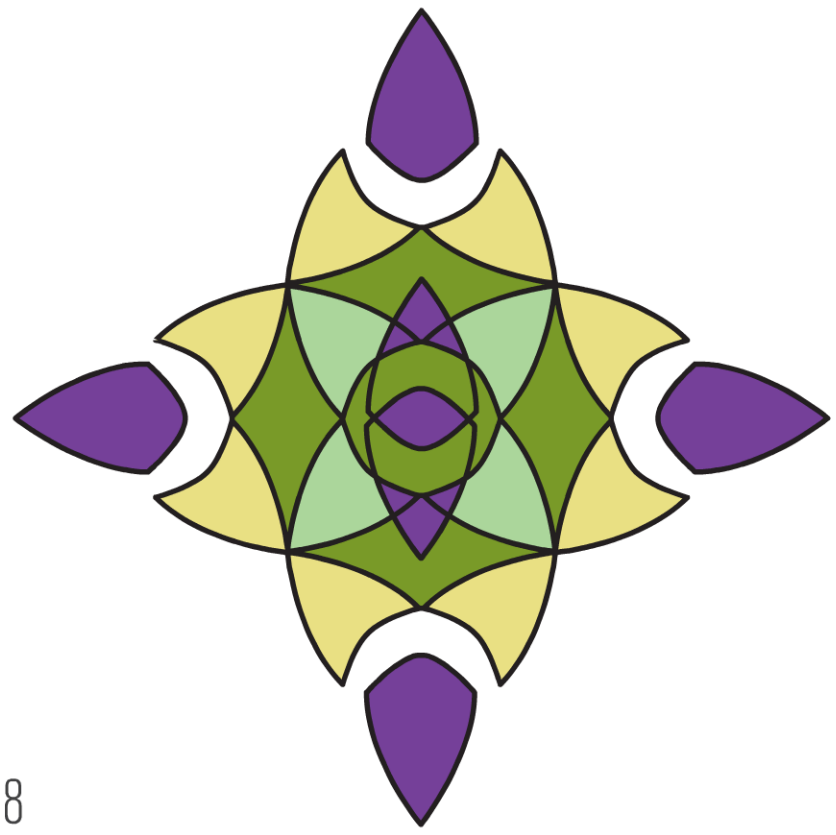

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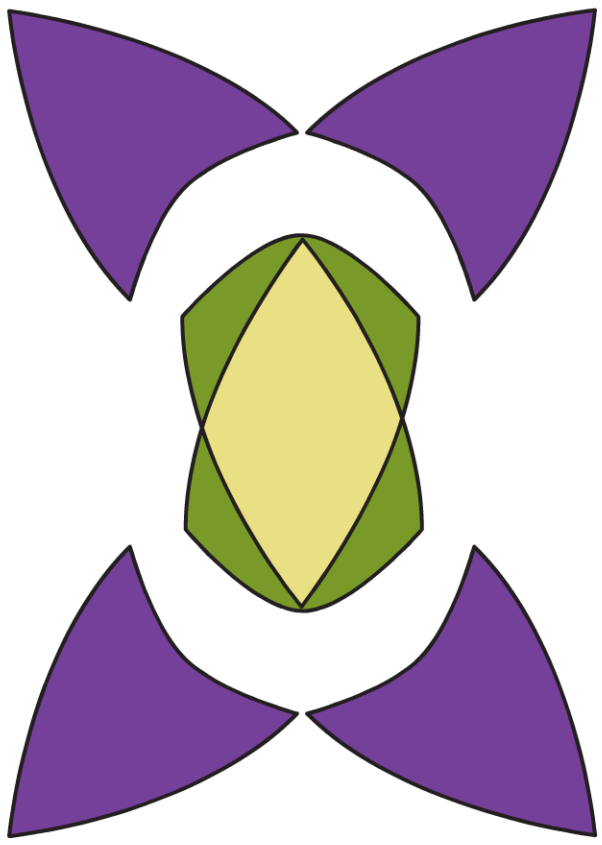

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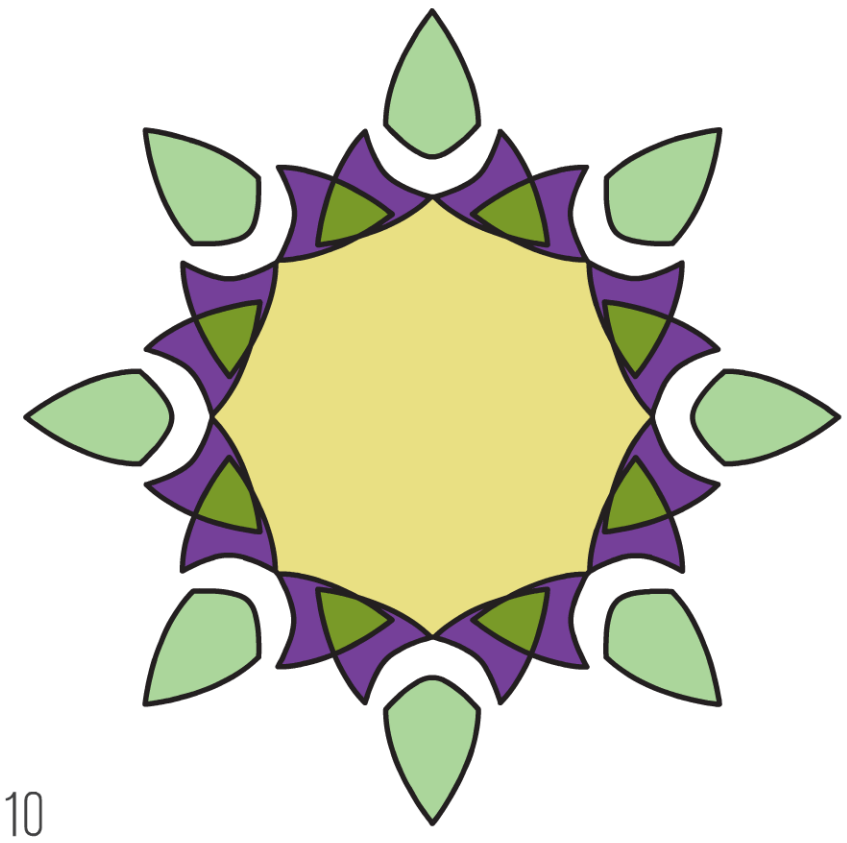

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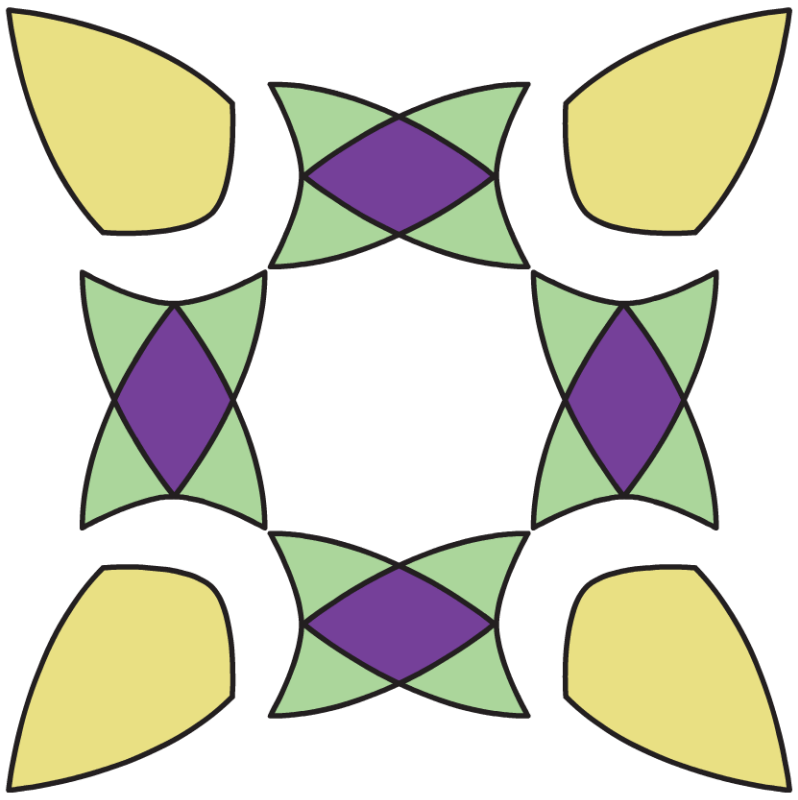

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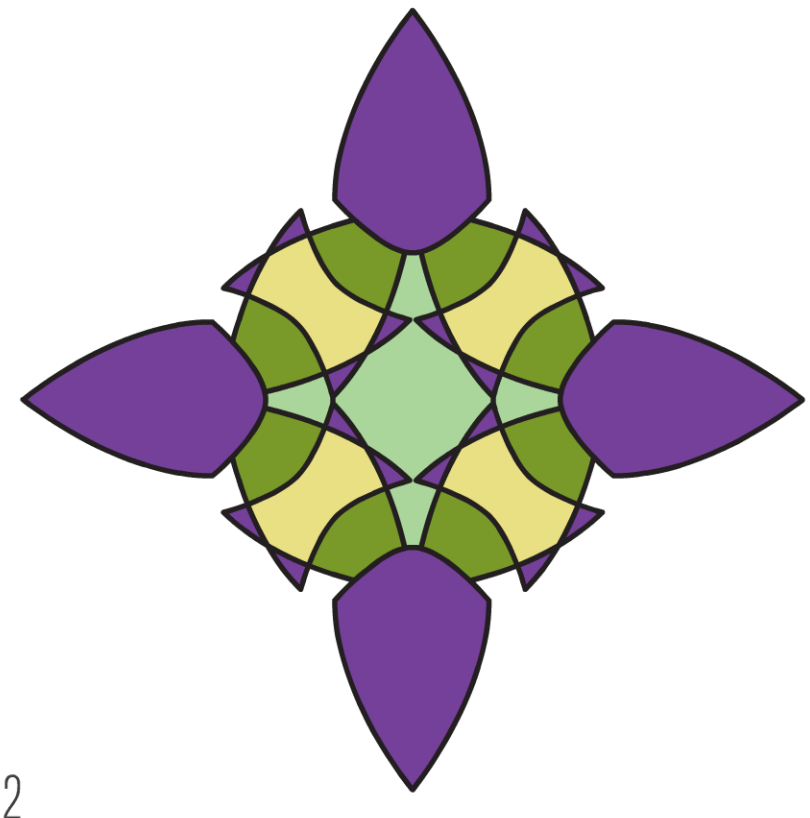

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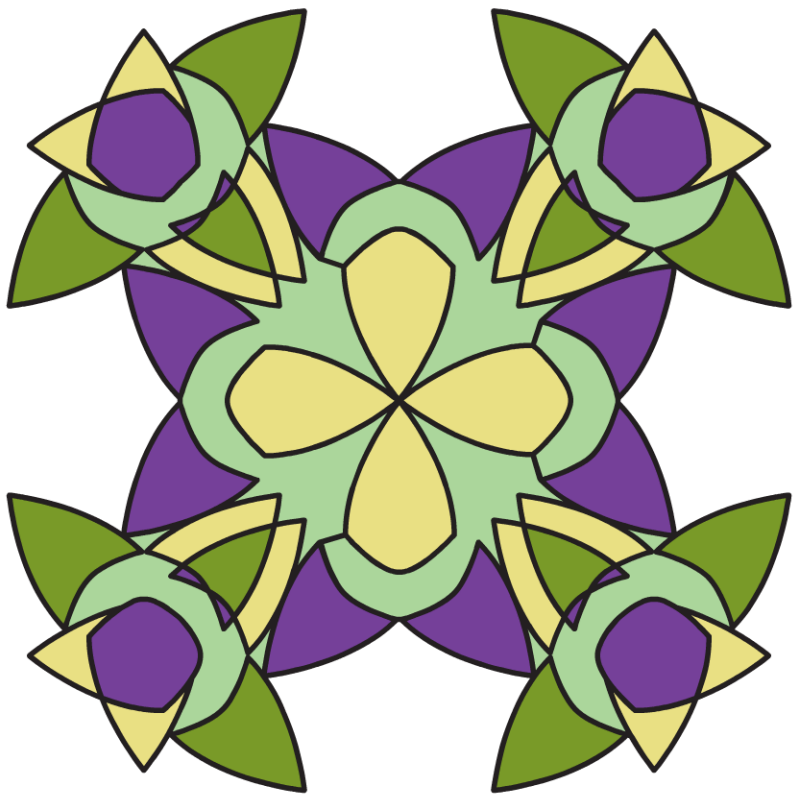

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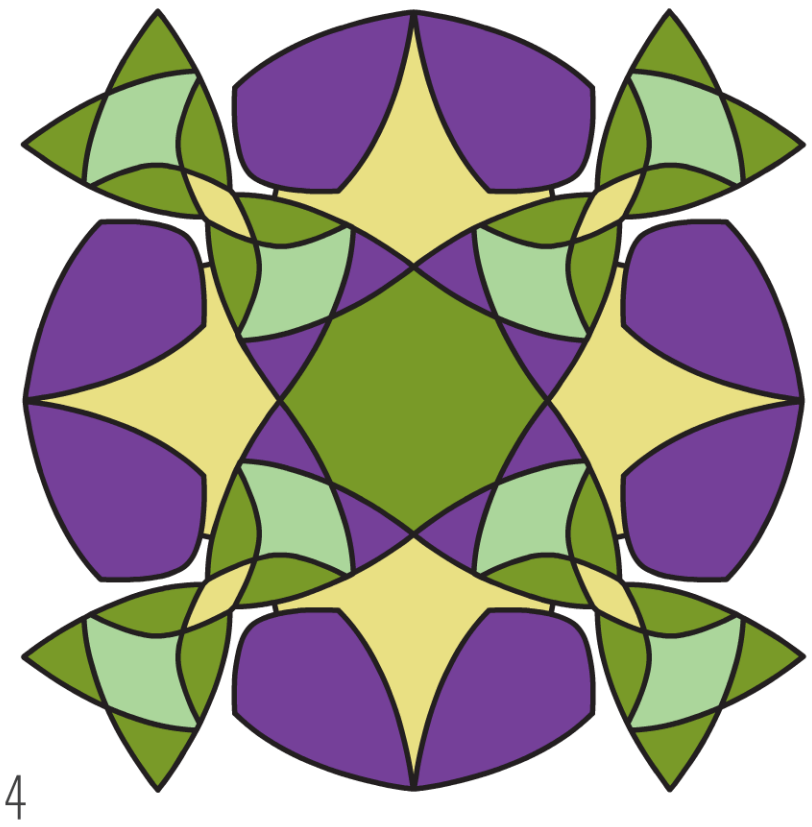

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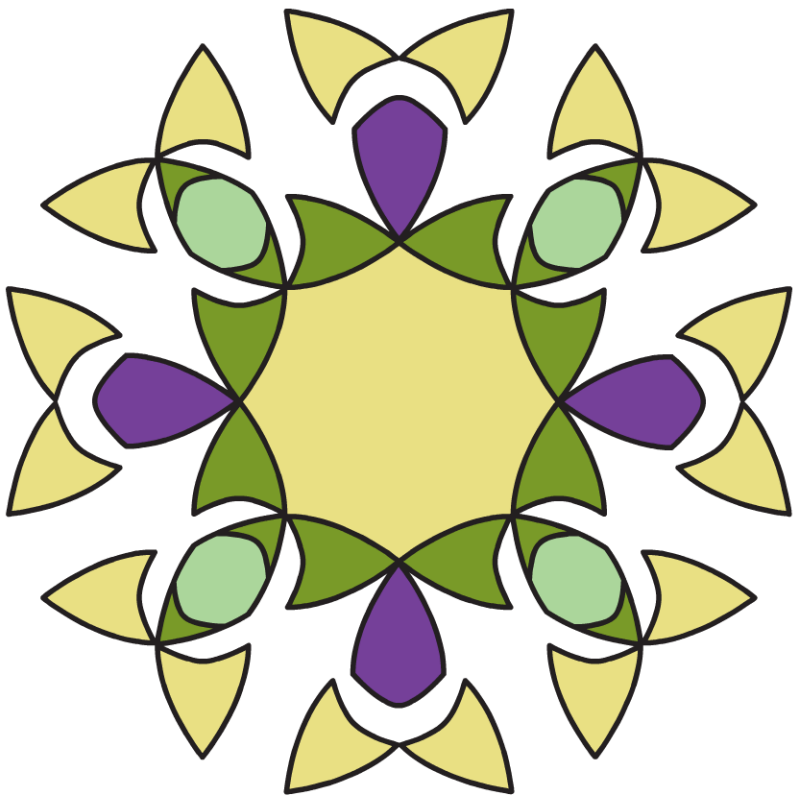

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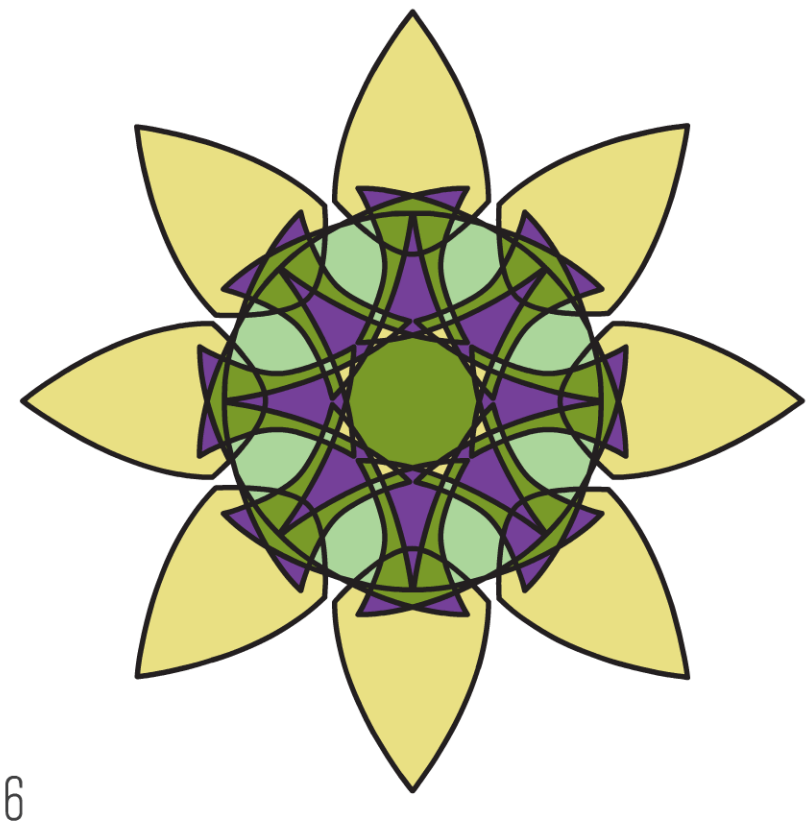

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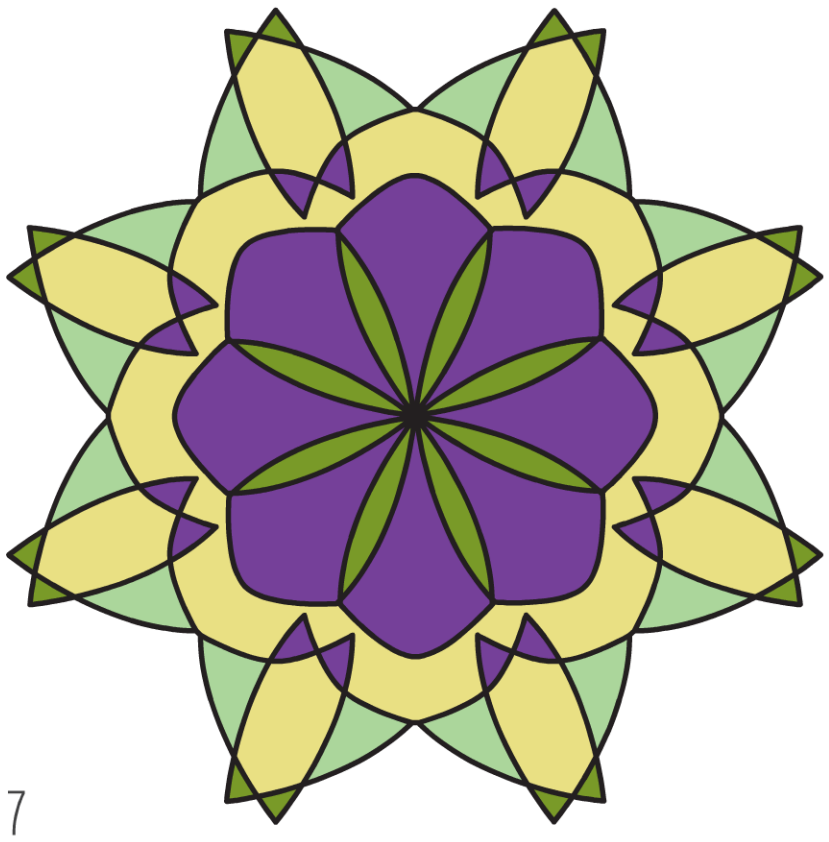

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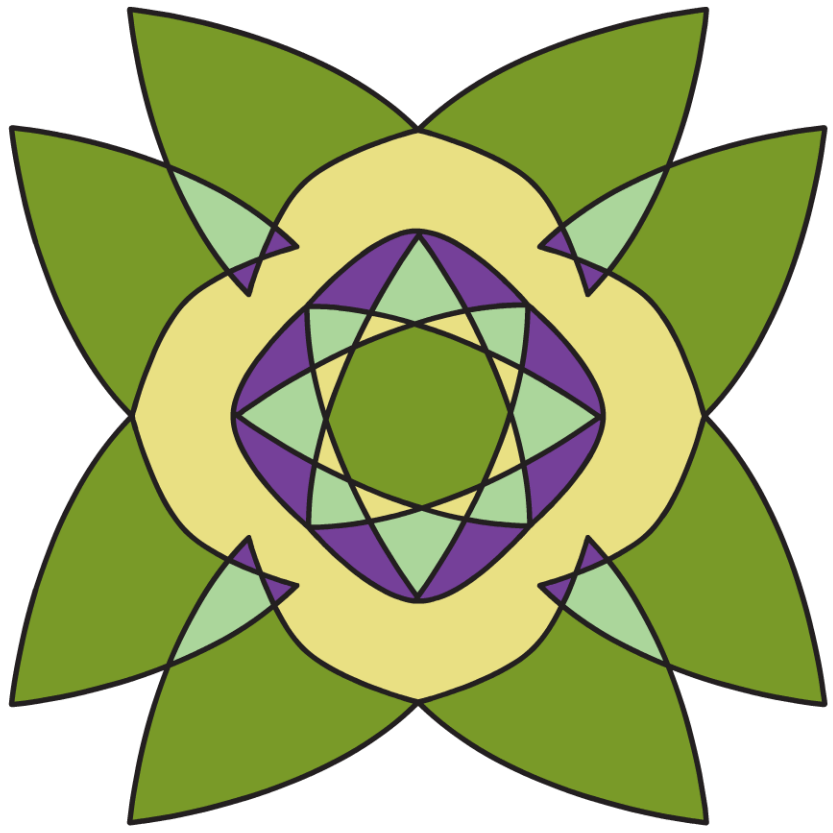

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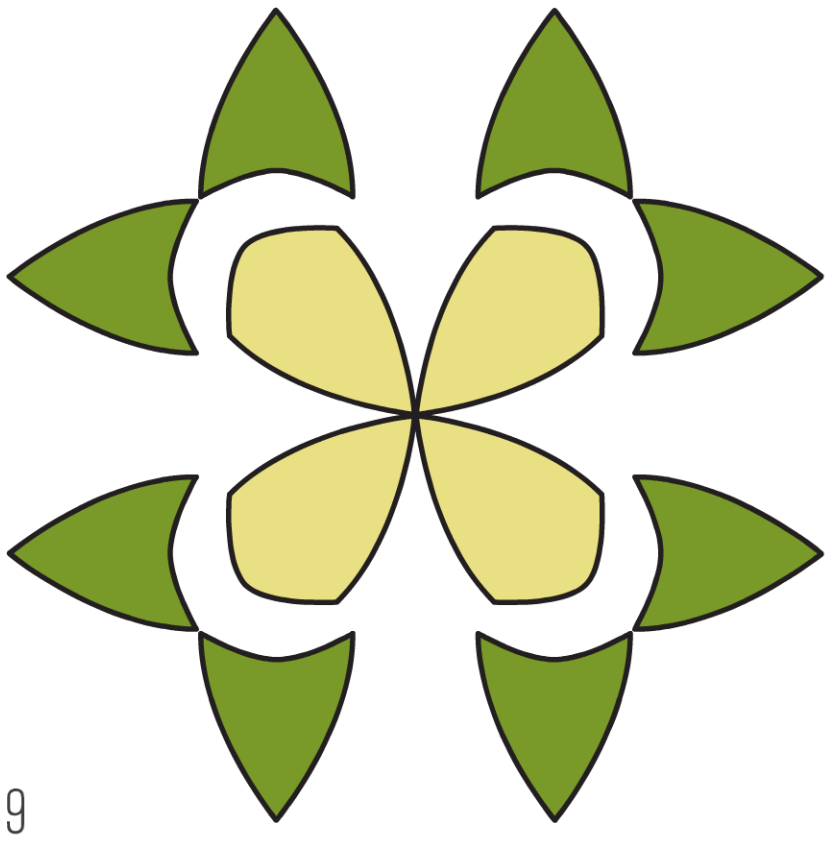

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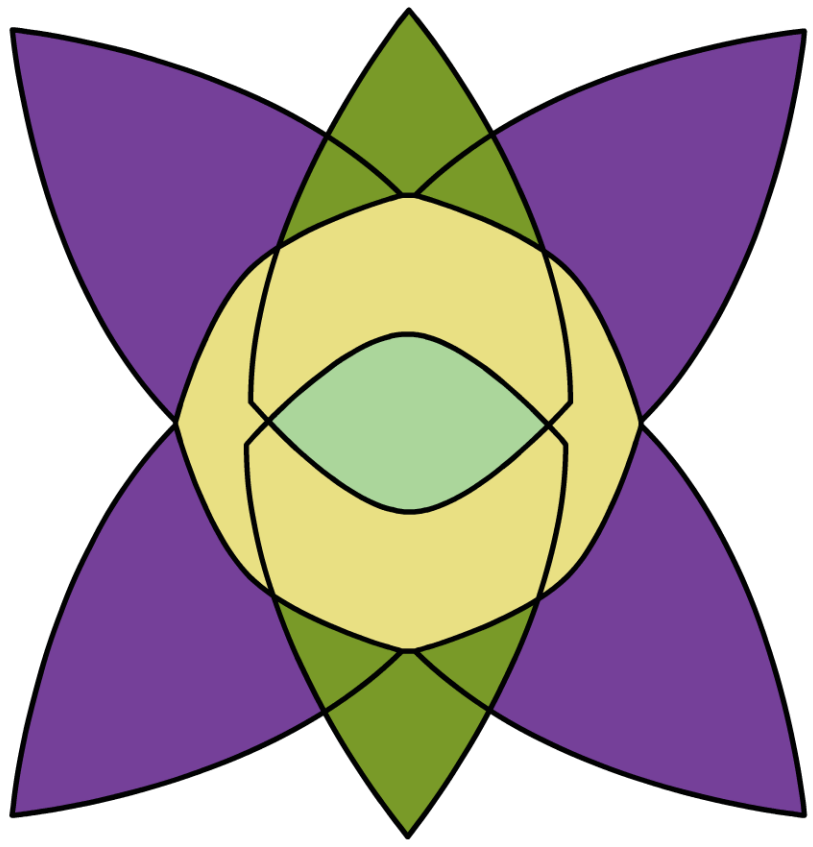

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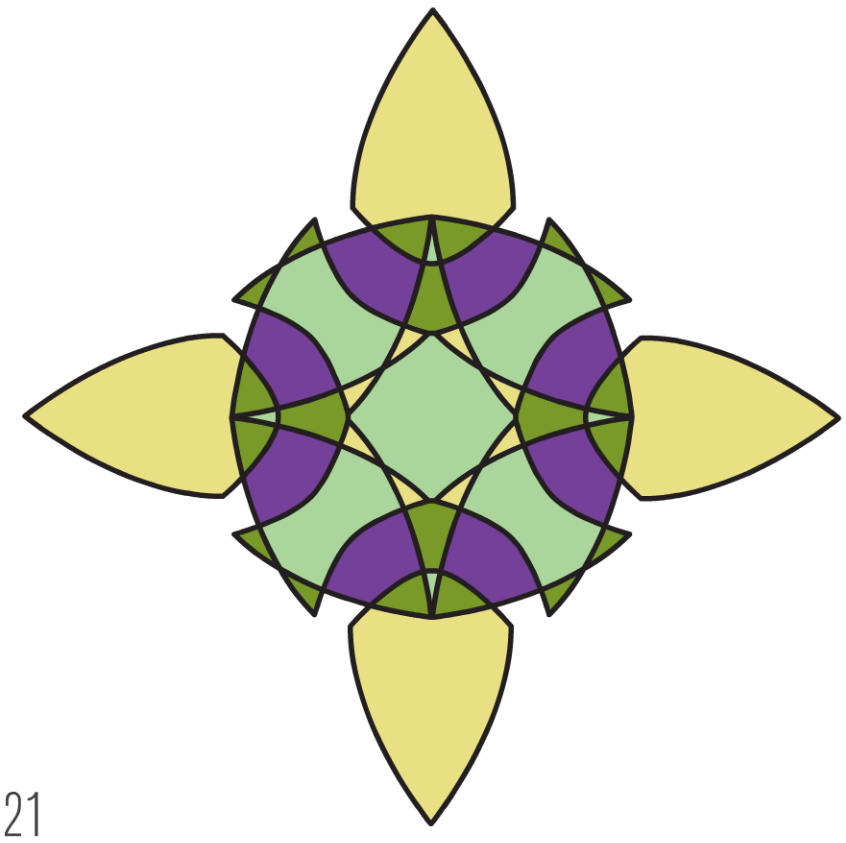

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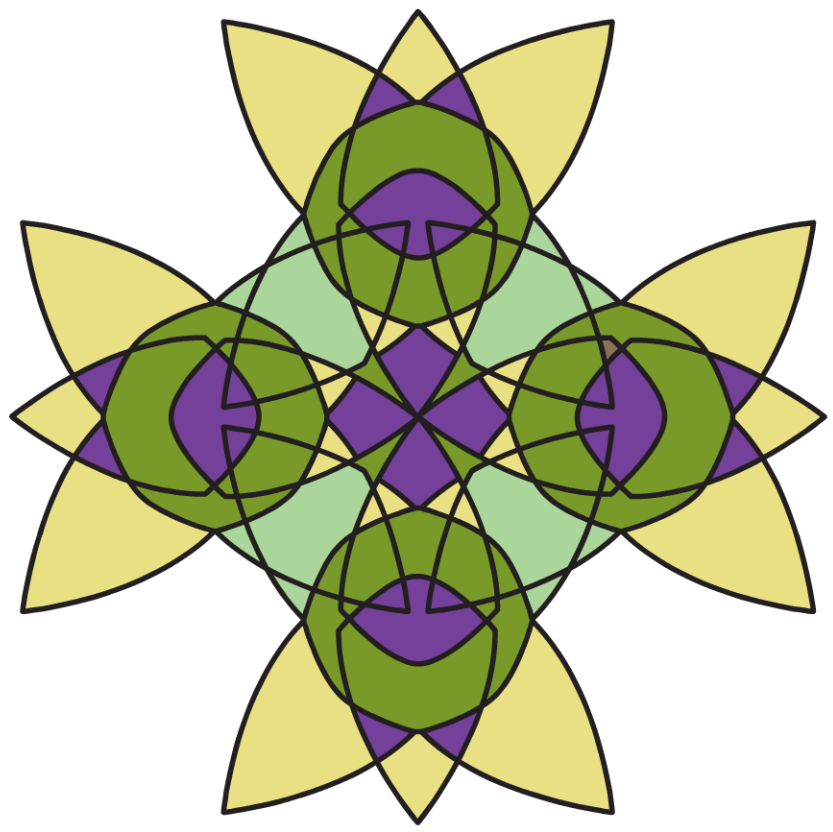

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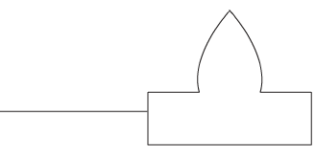

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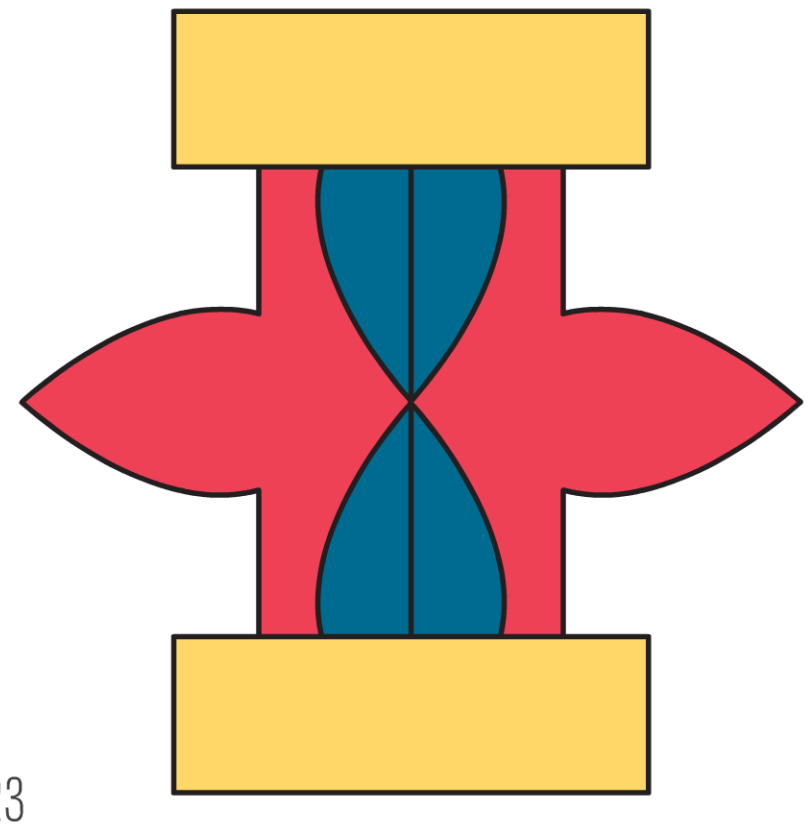

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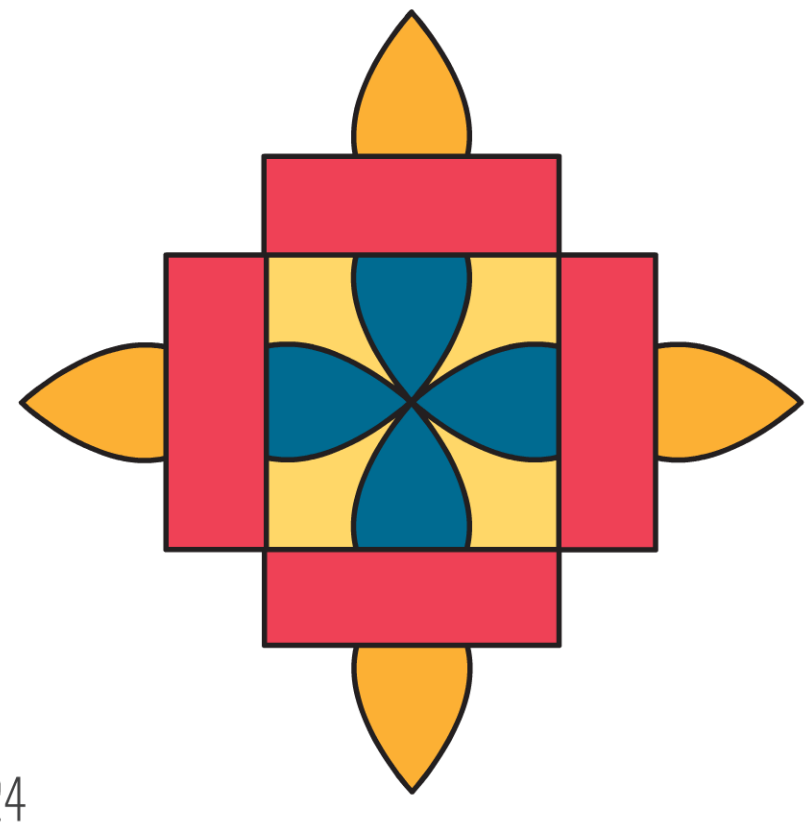

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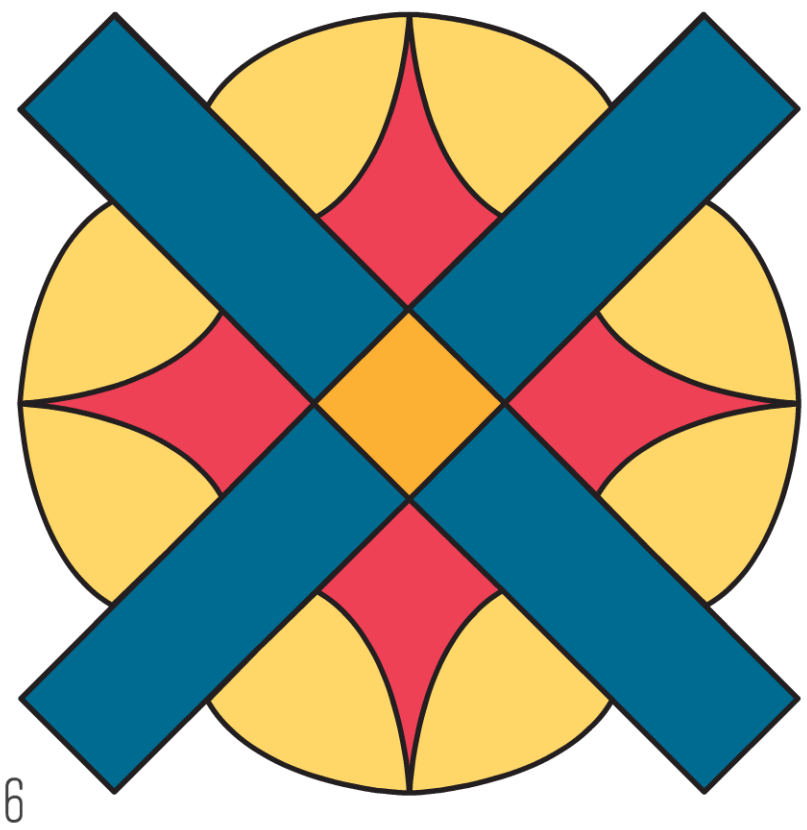

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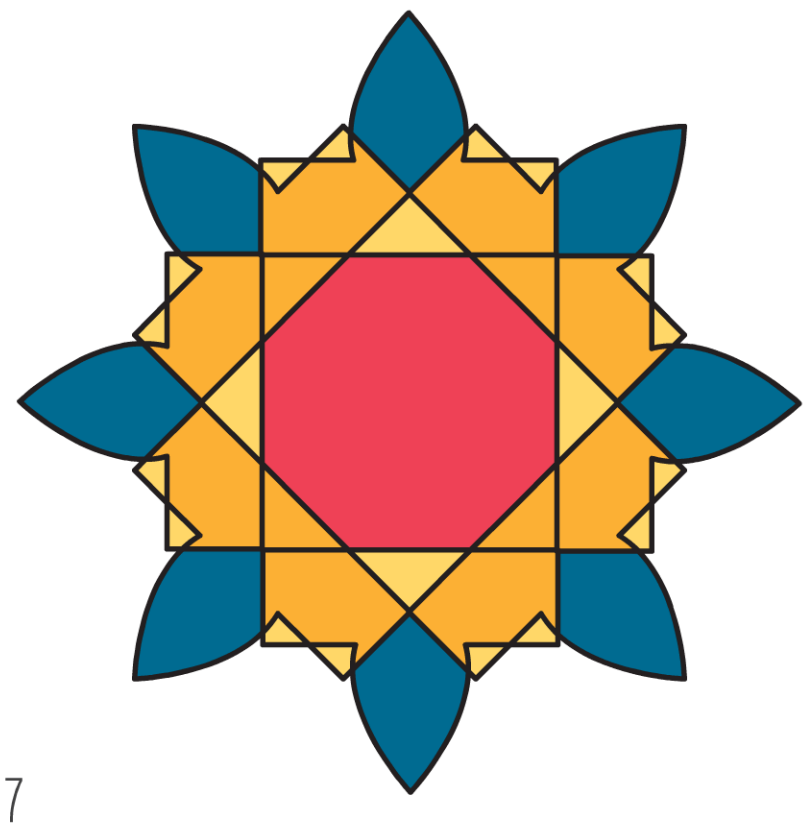

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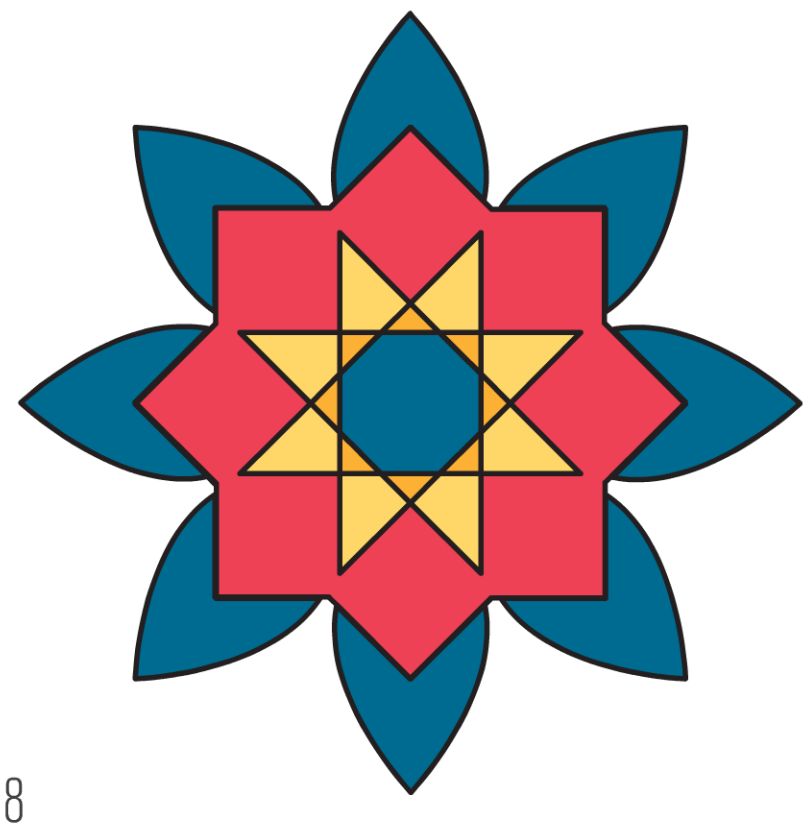

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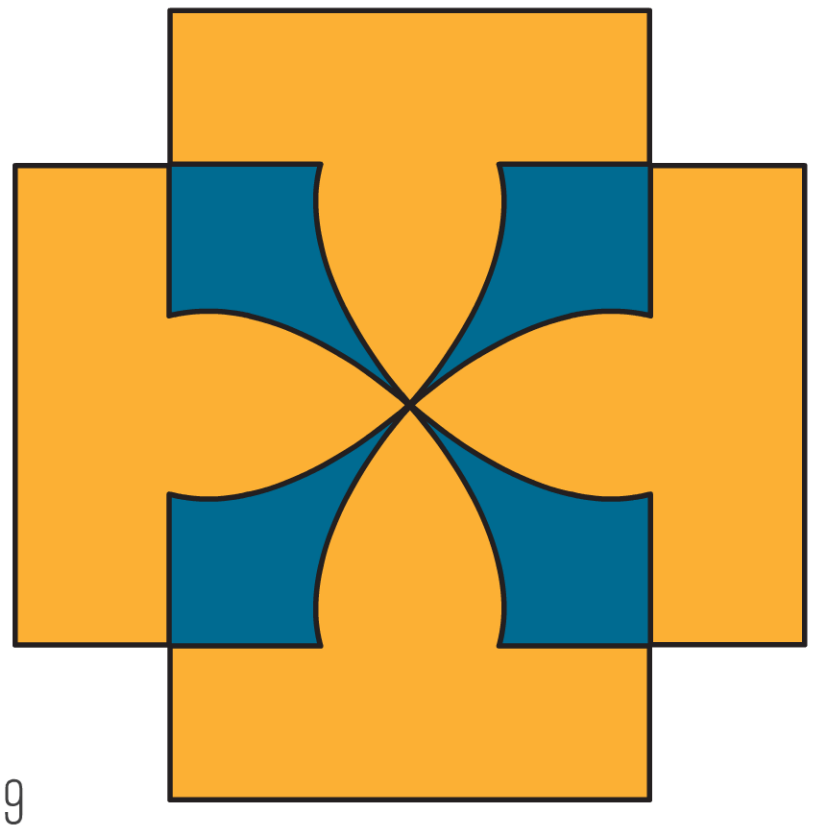

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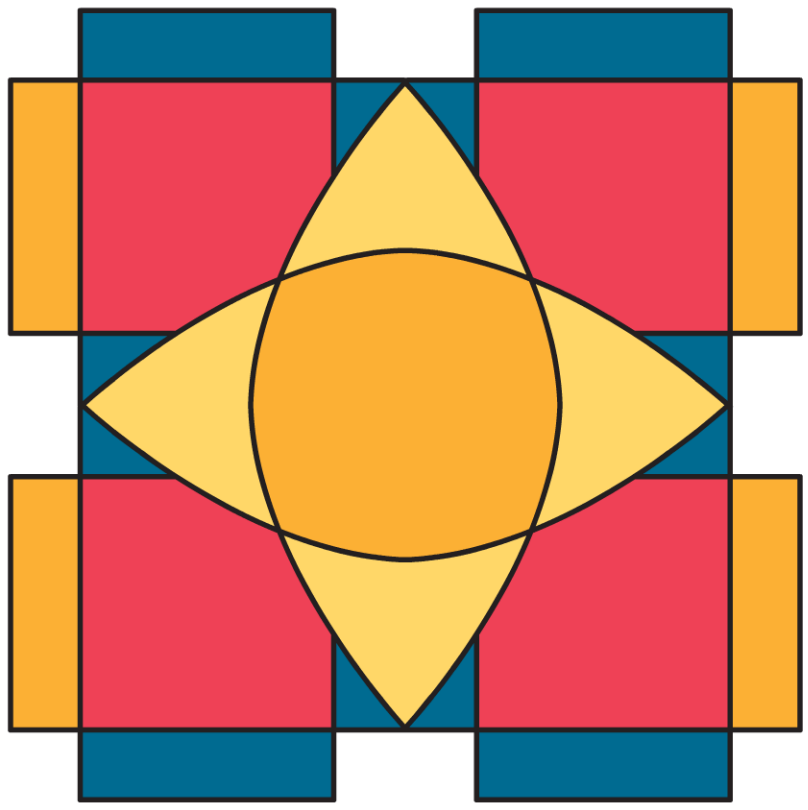

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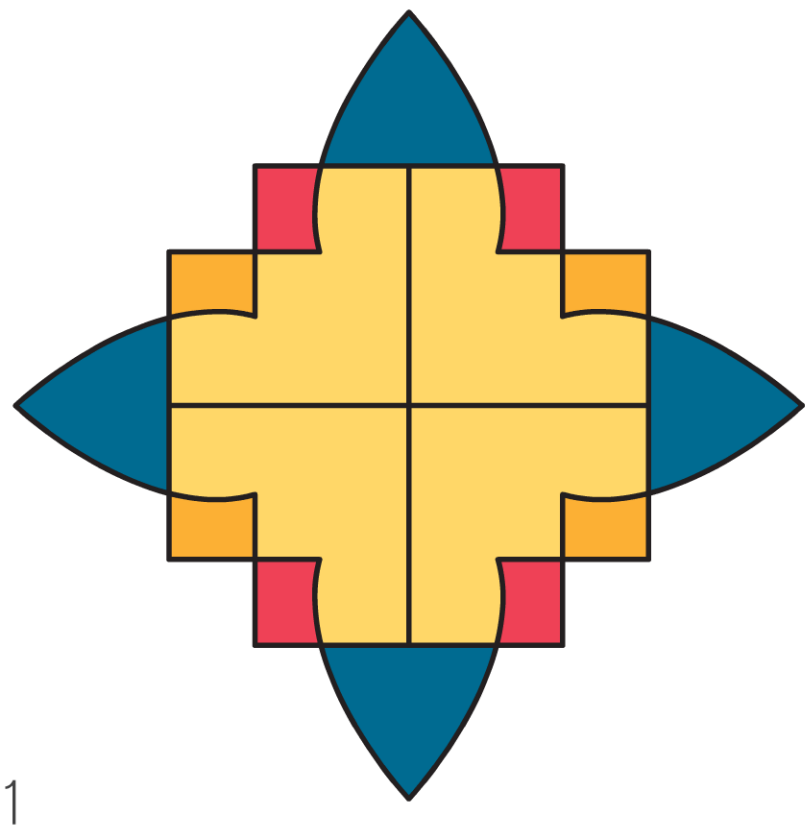

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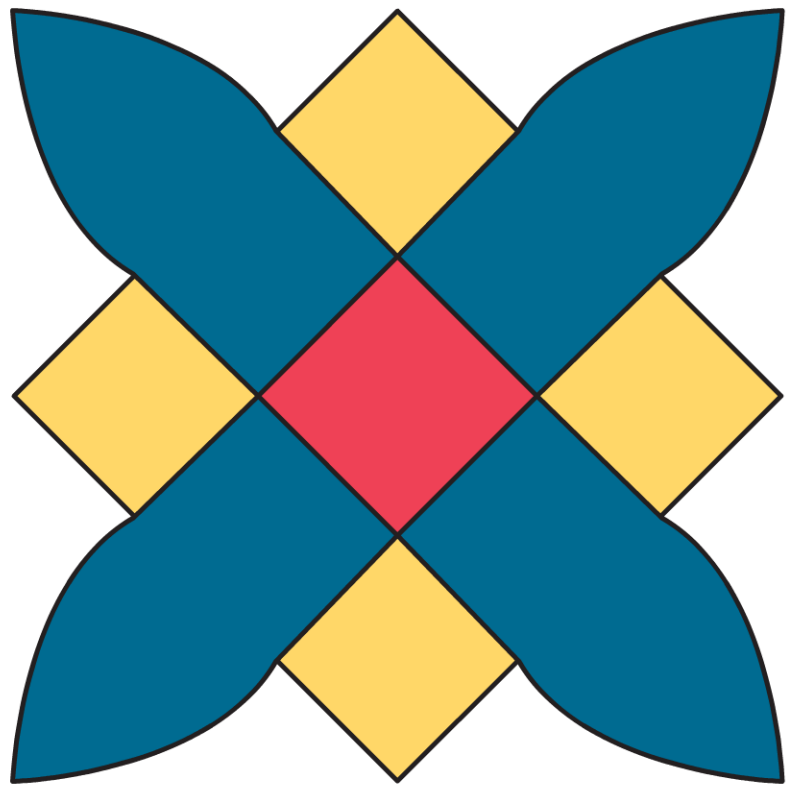

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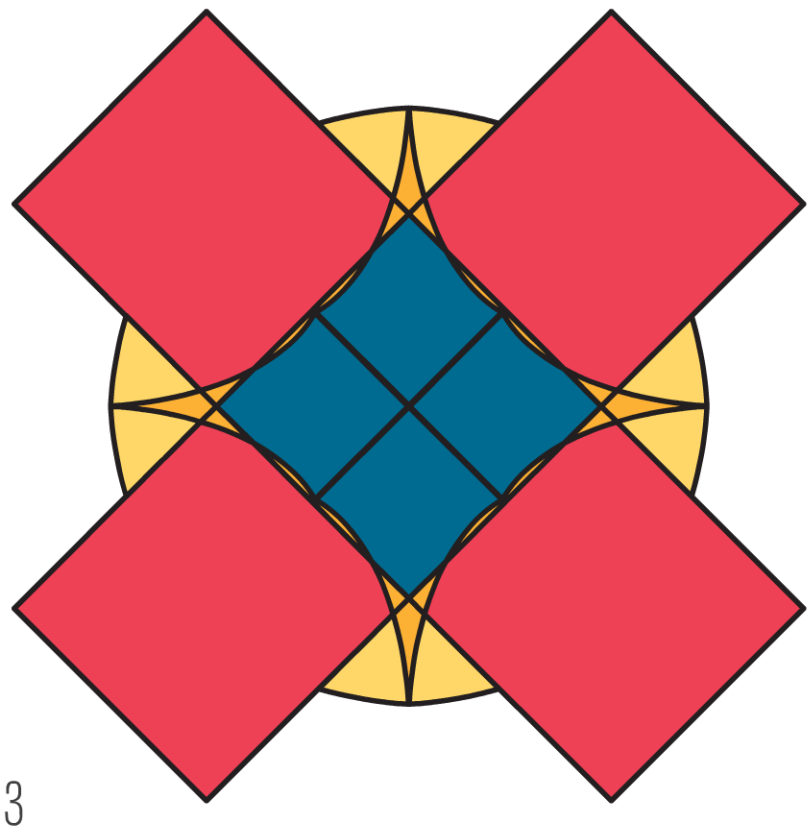

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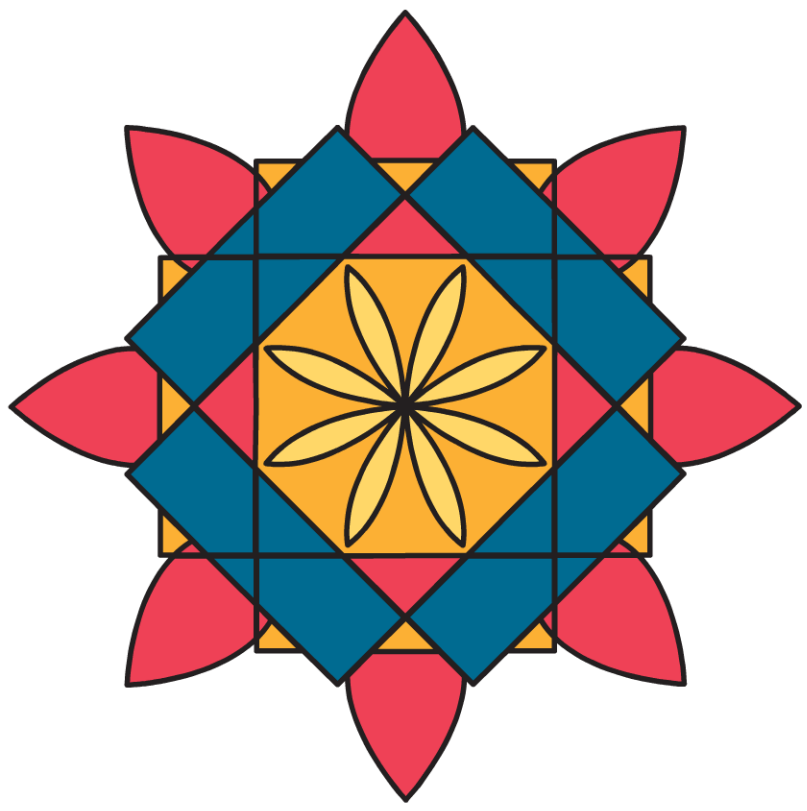

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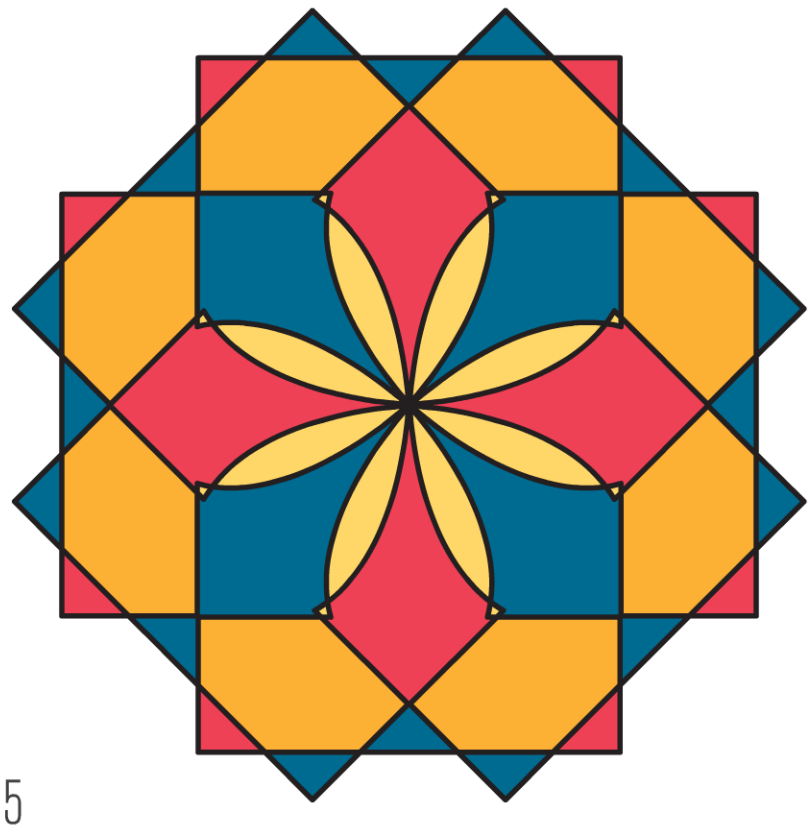

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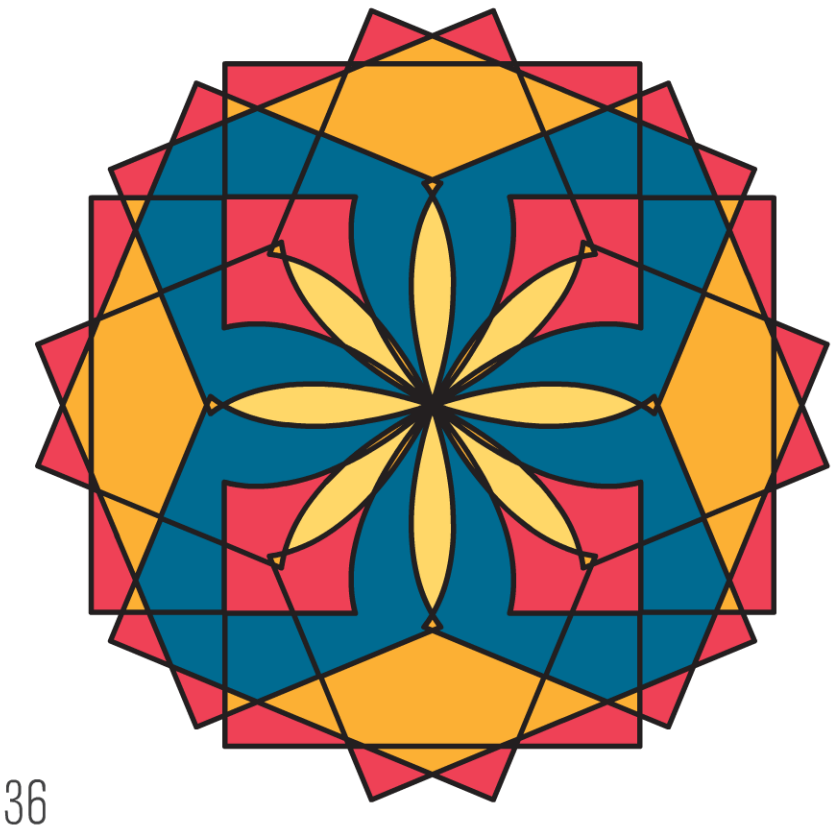

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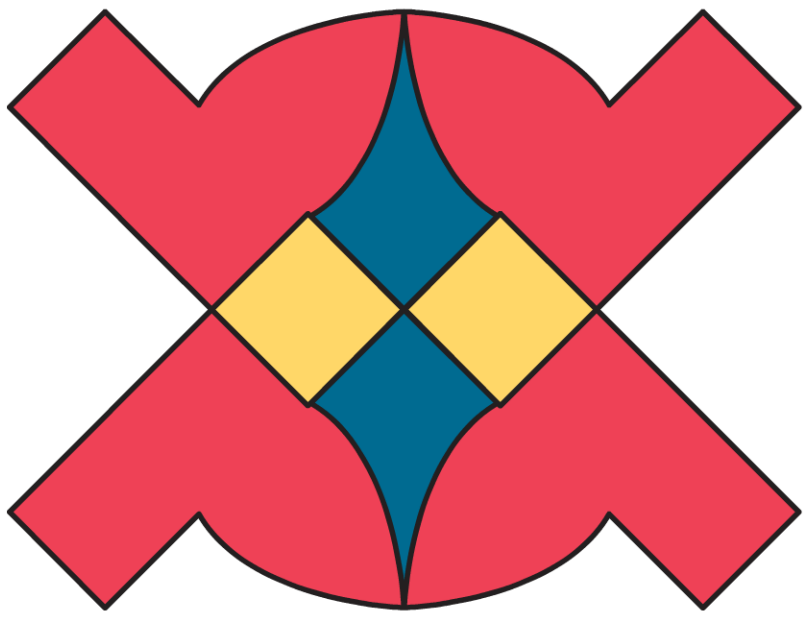

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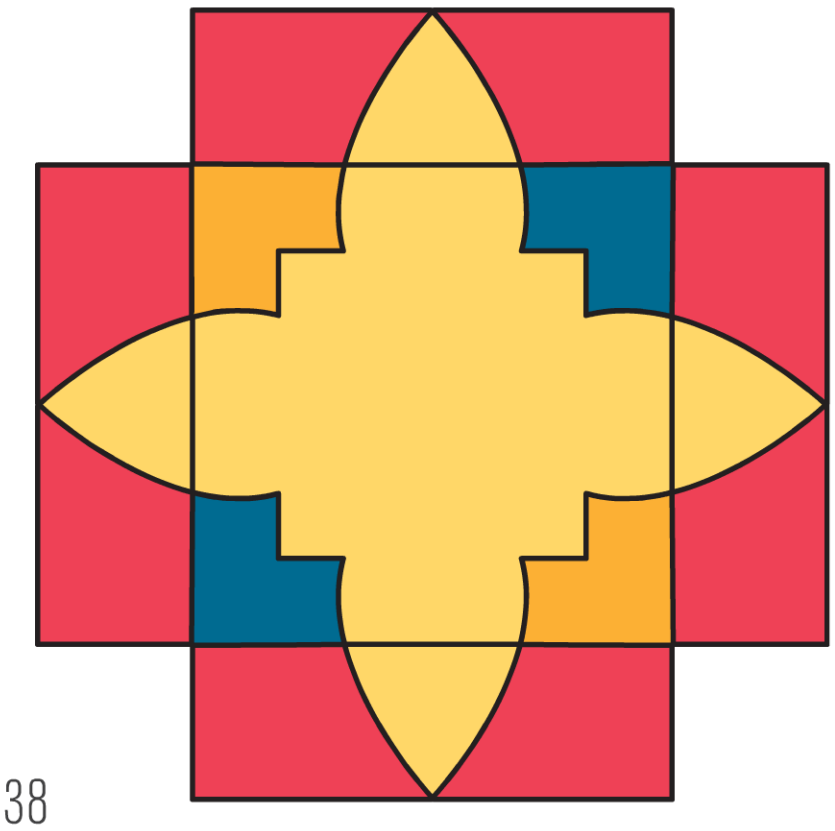

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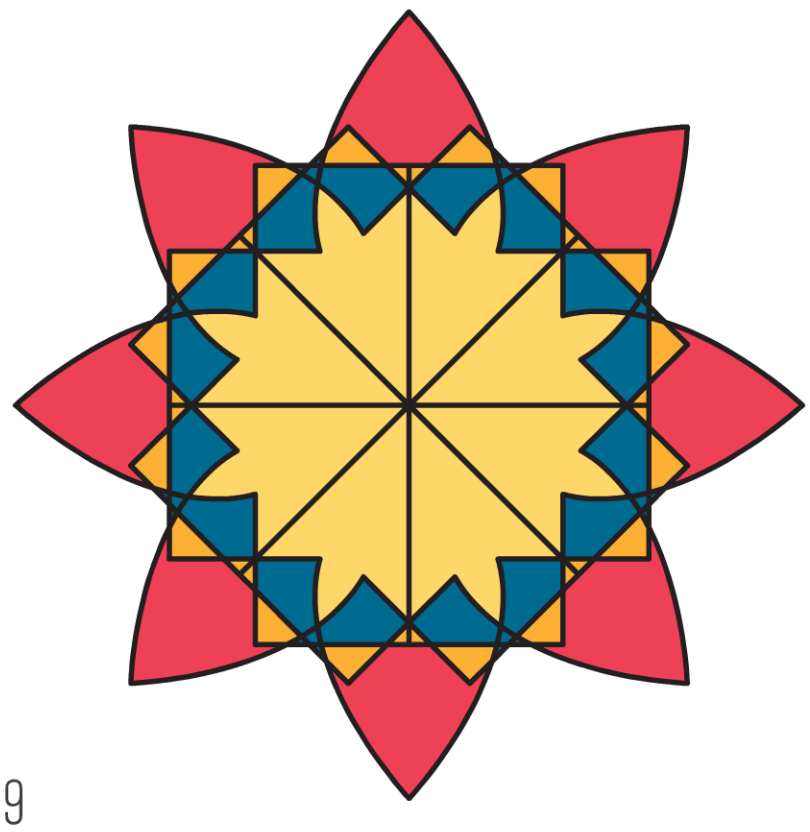

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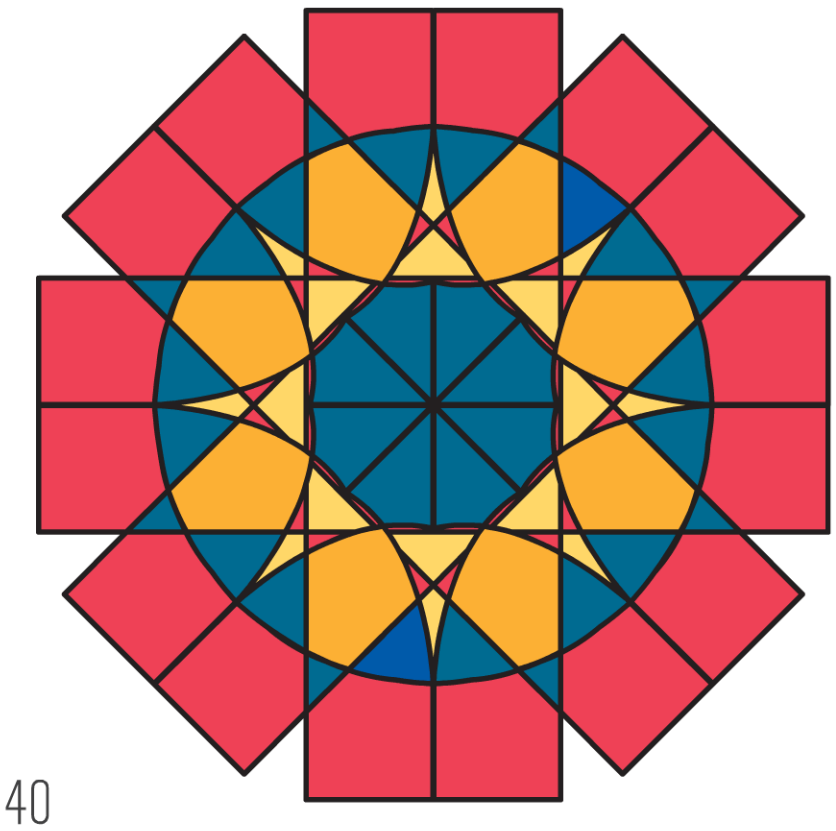

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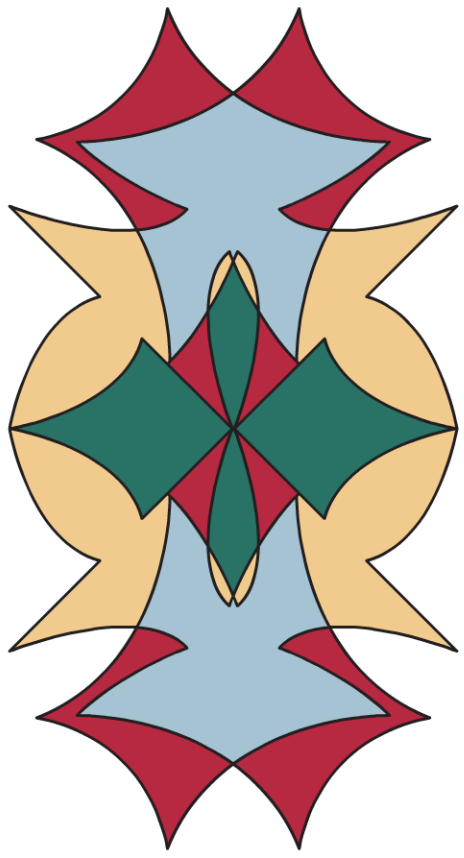

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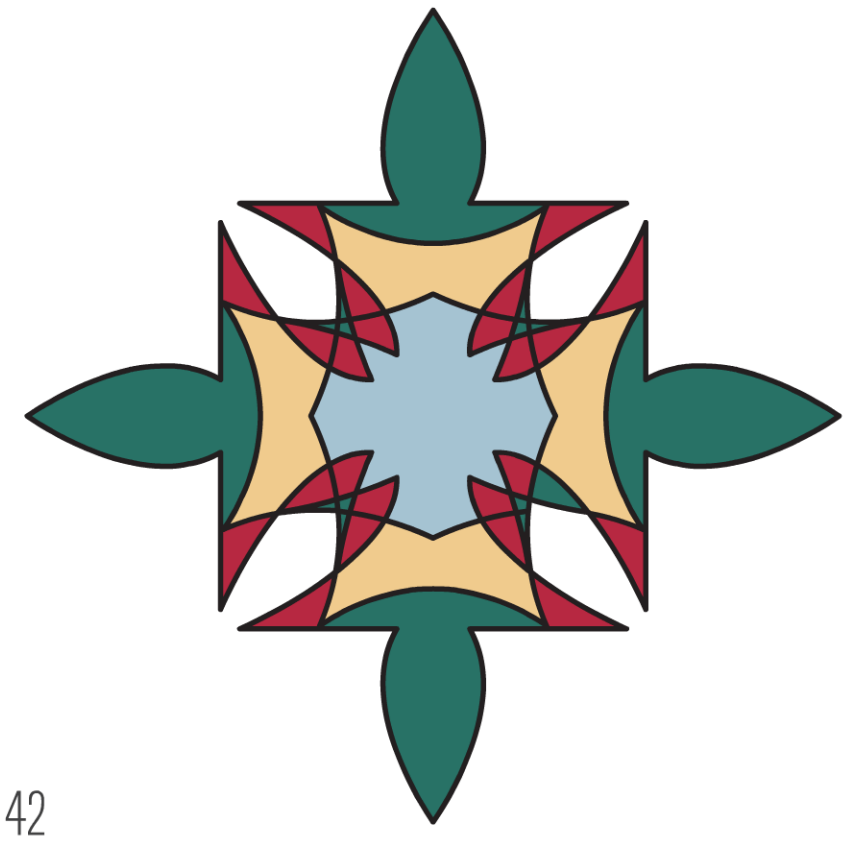

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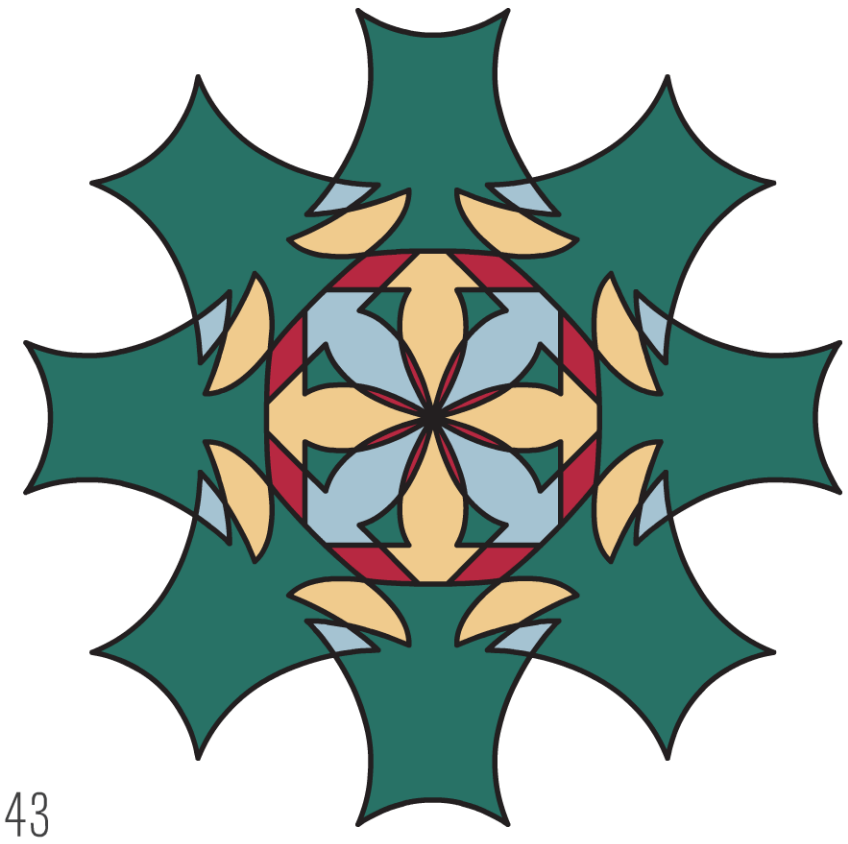

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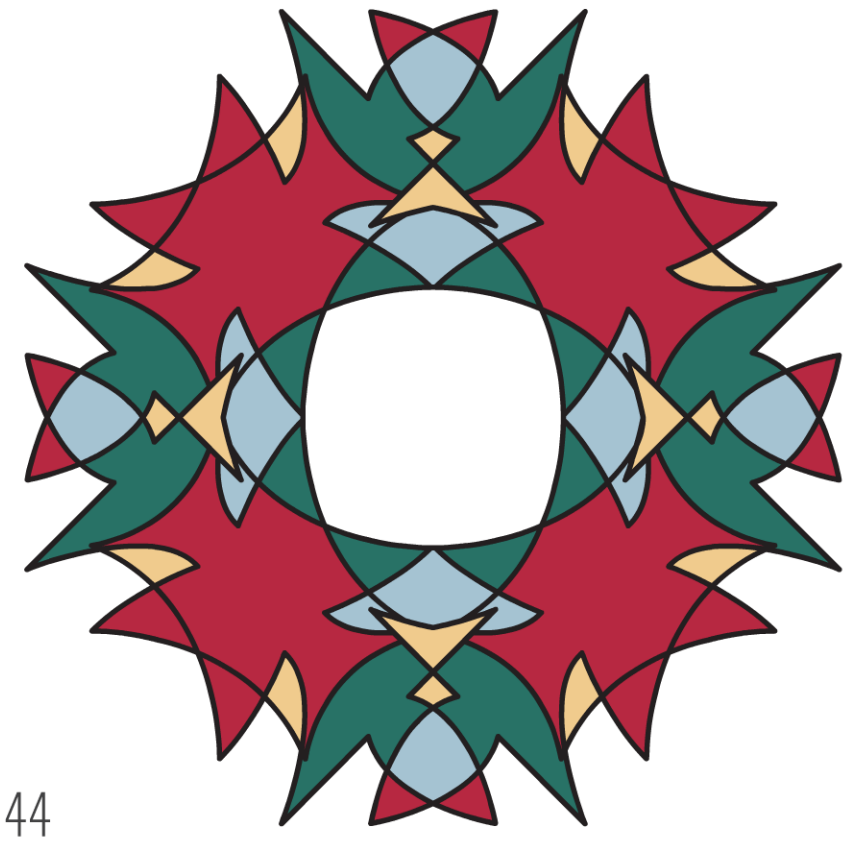

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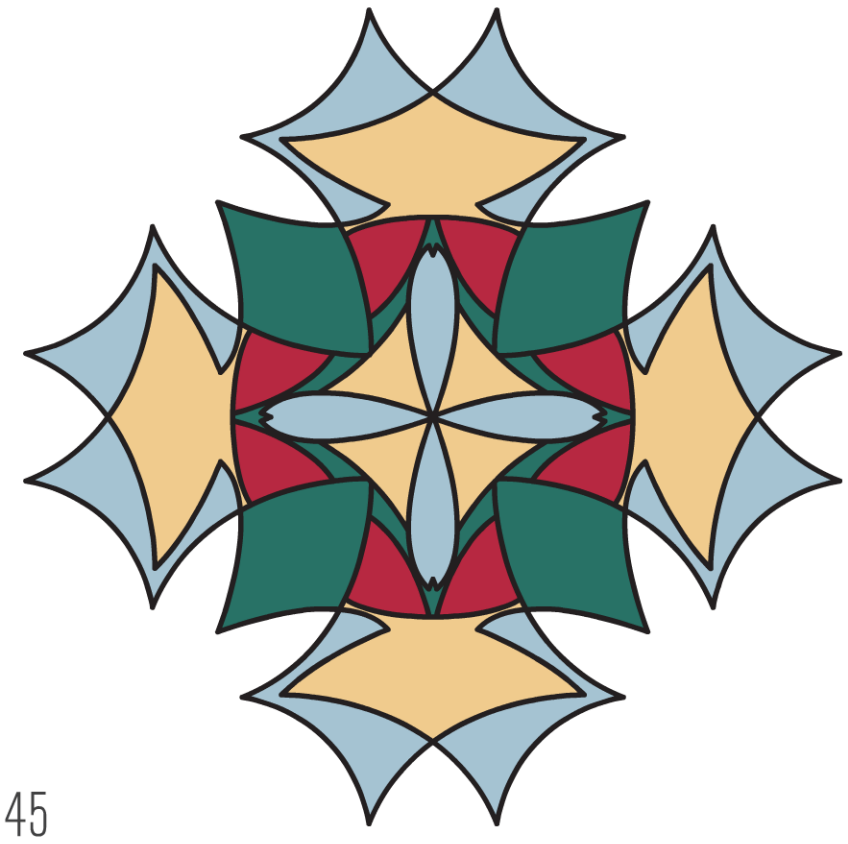

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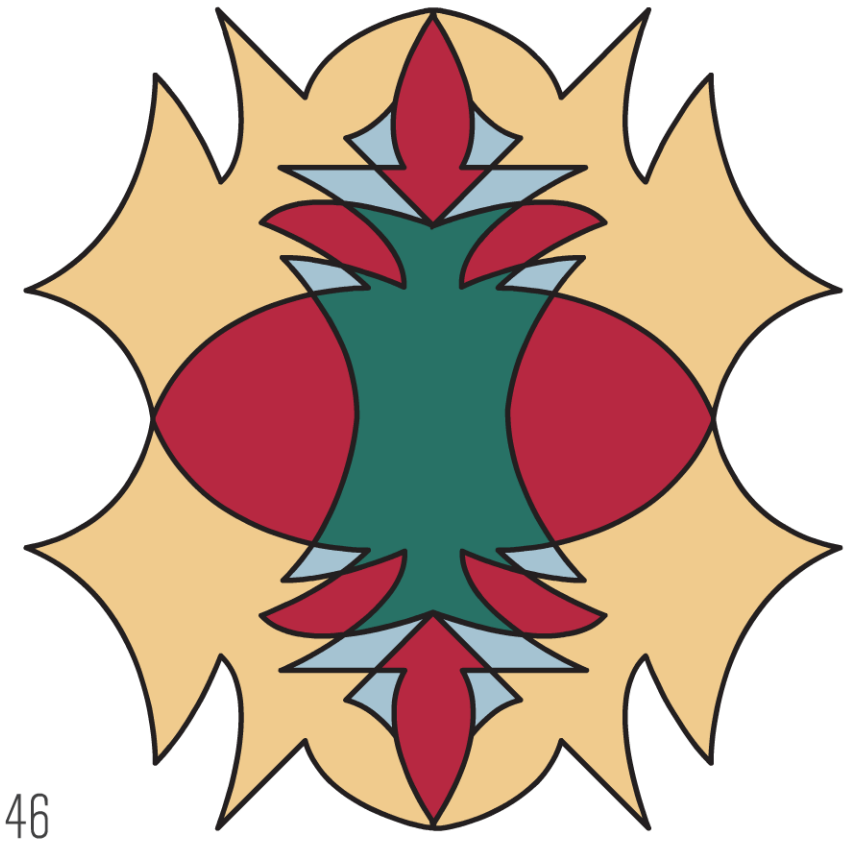

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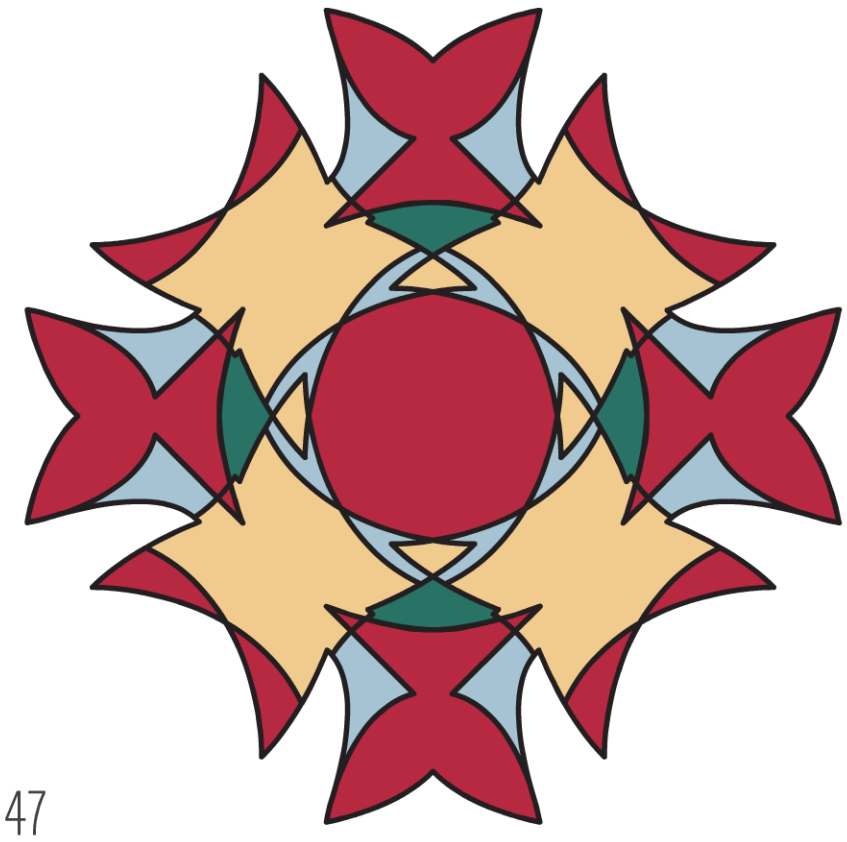

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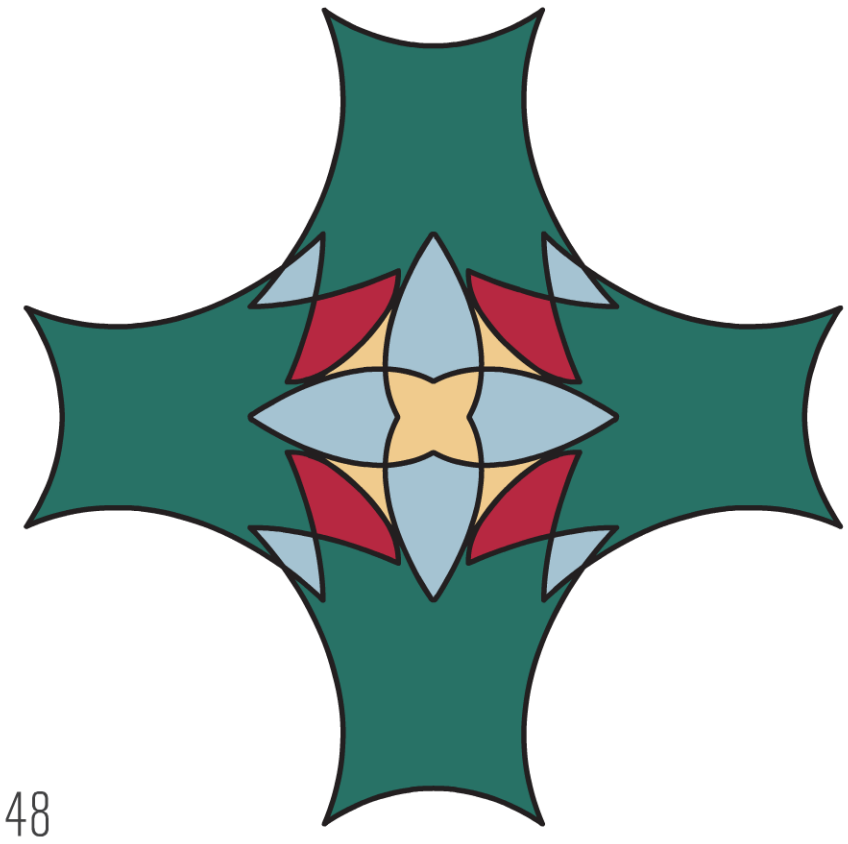

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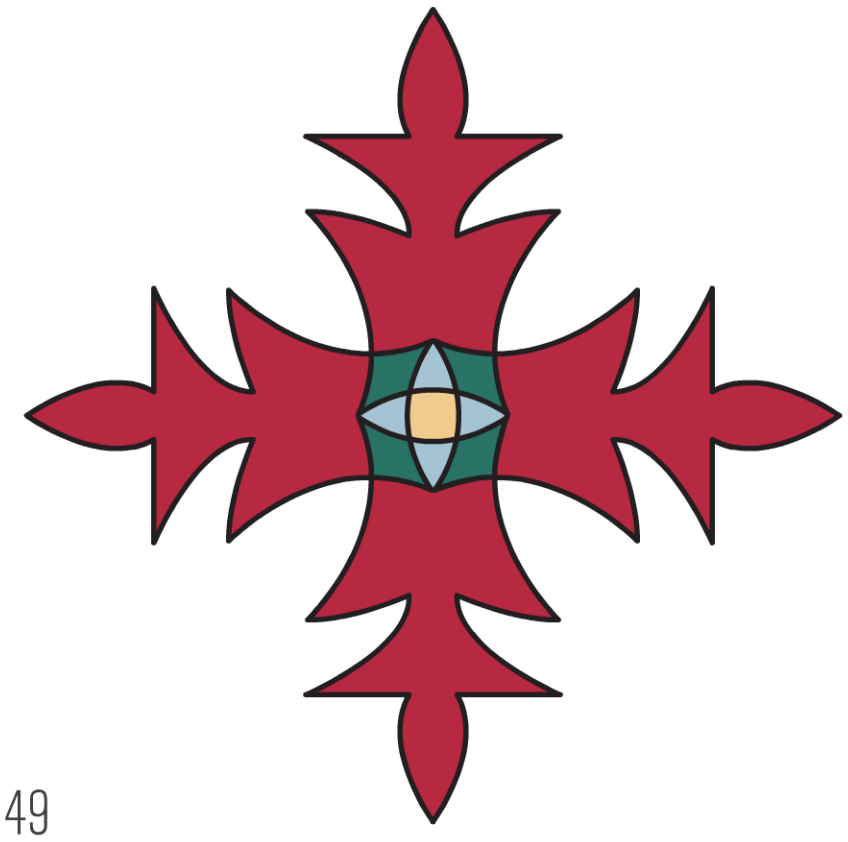

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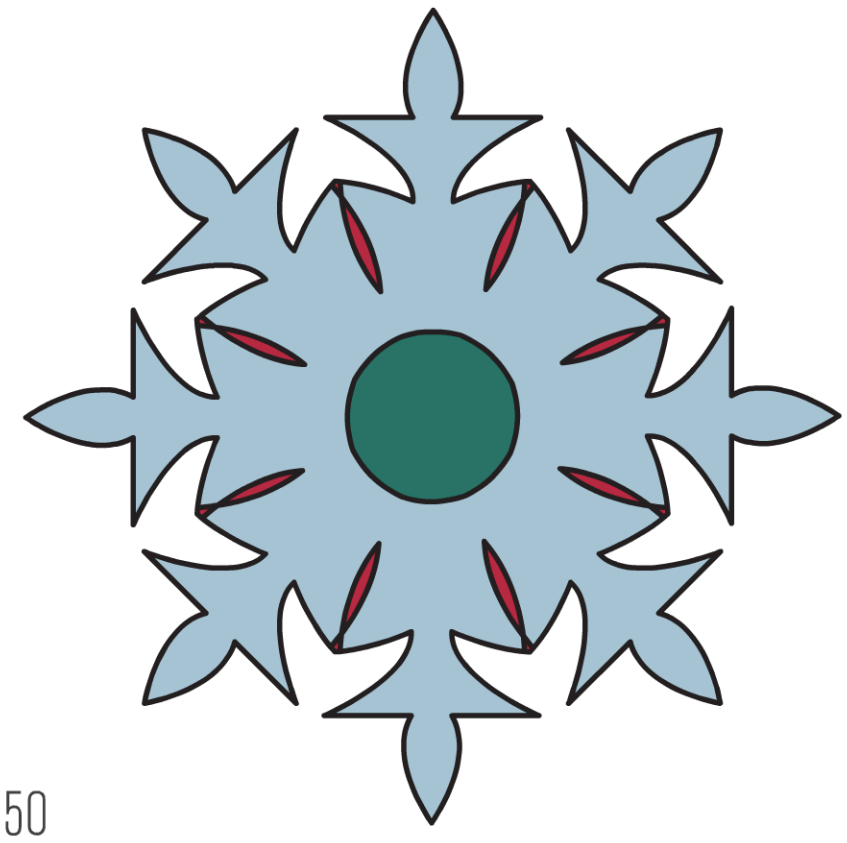

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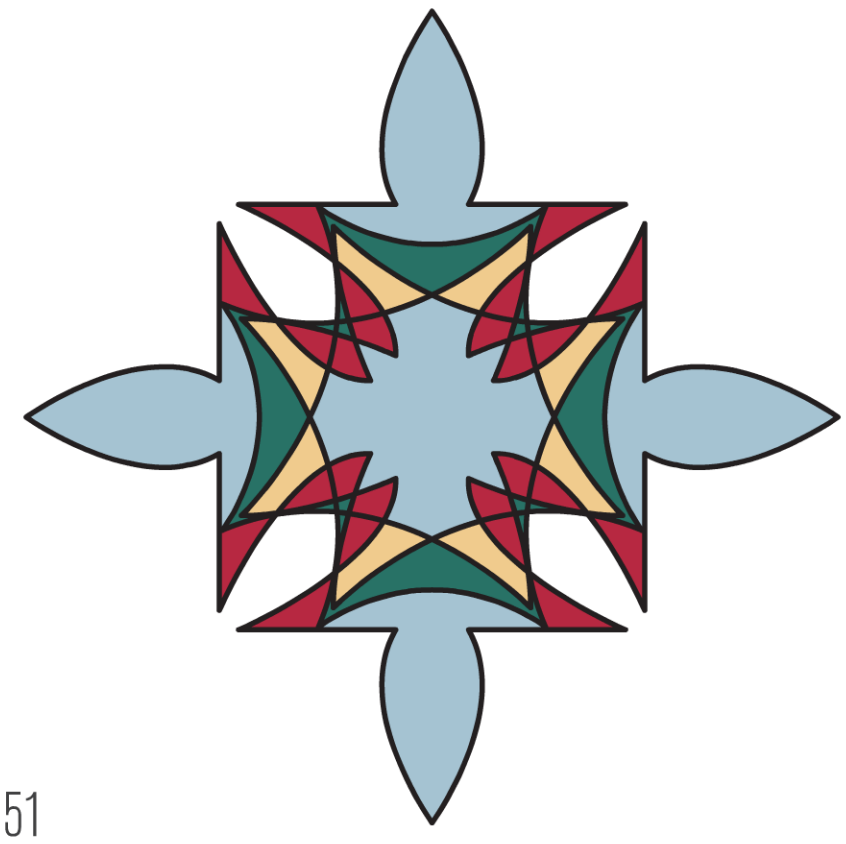

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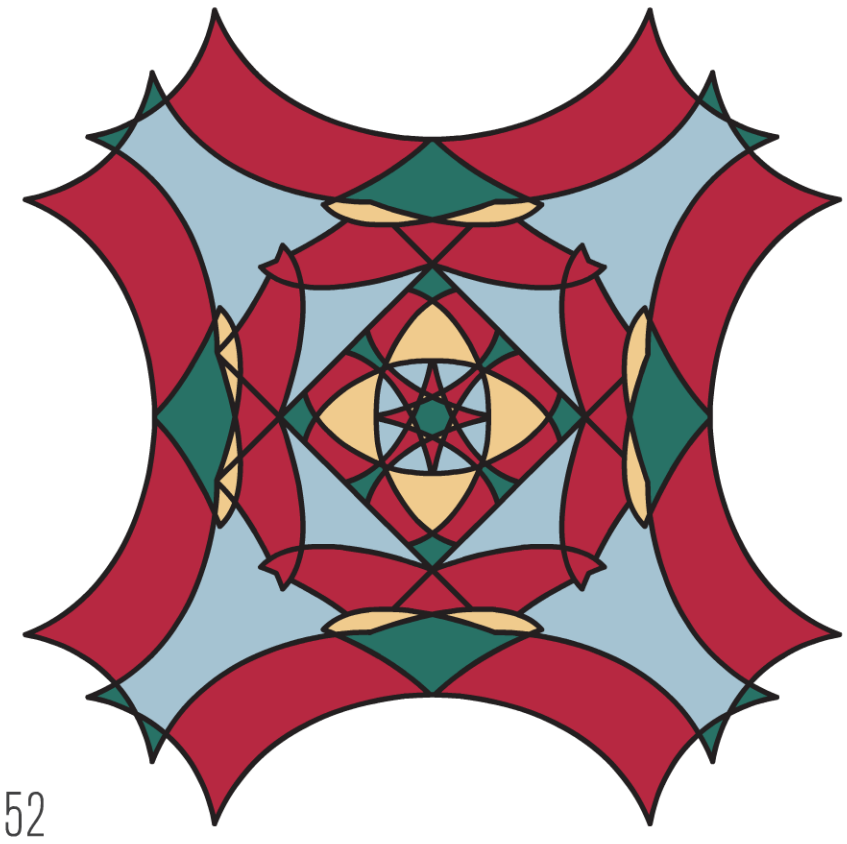

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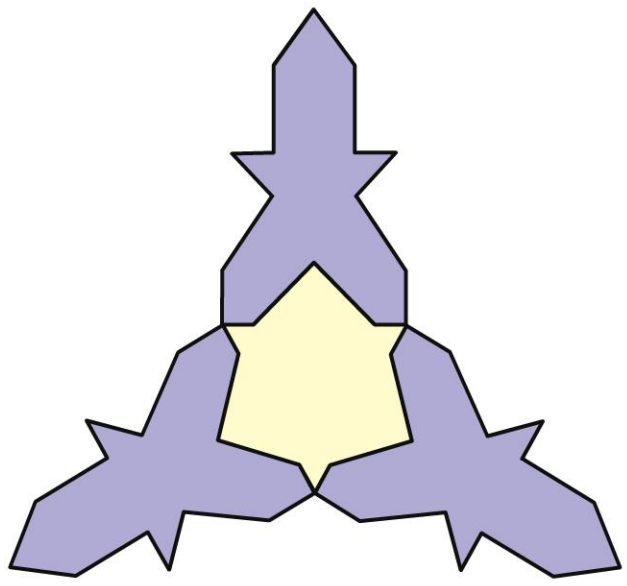
Candle Holders



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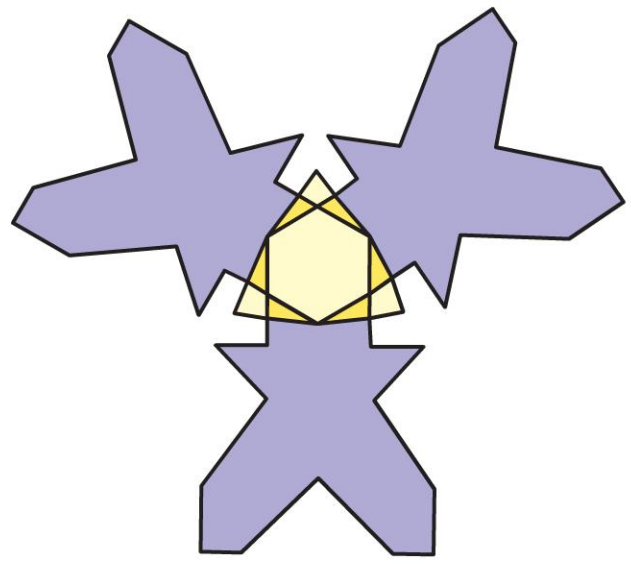

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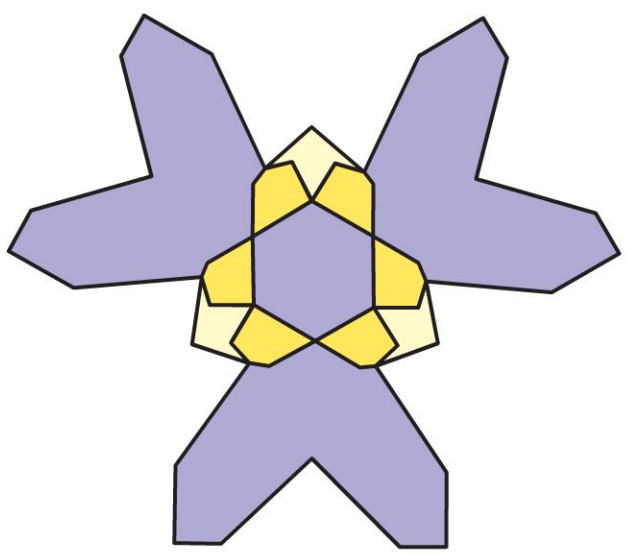

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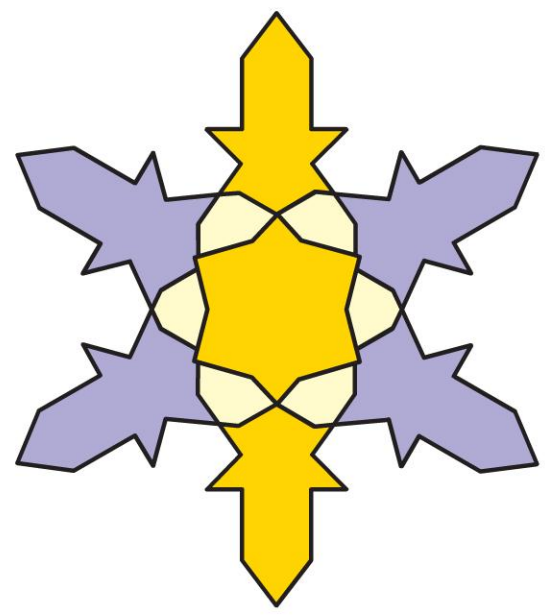

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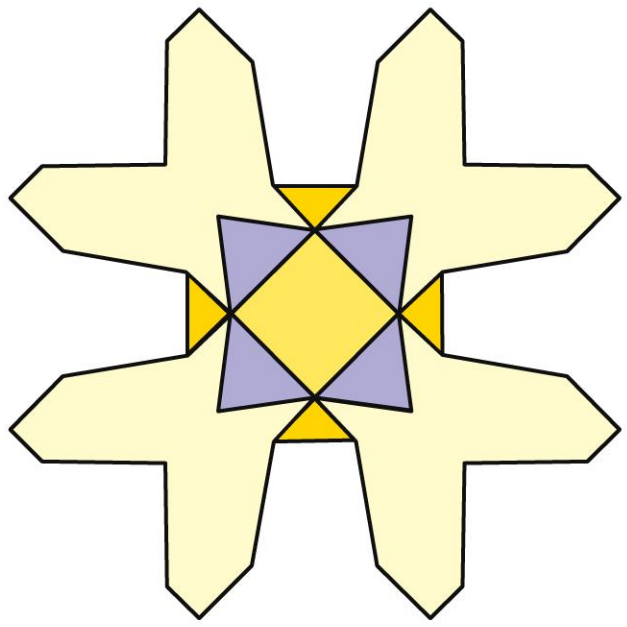

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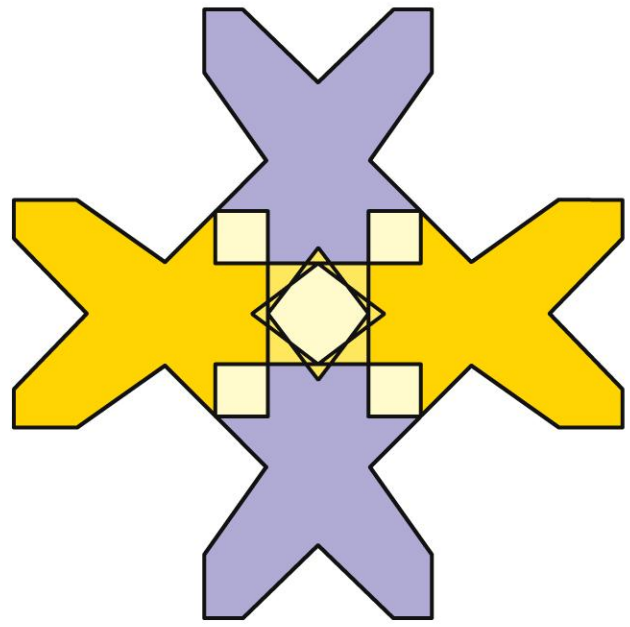

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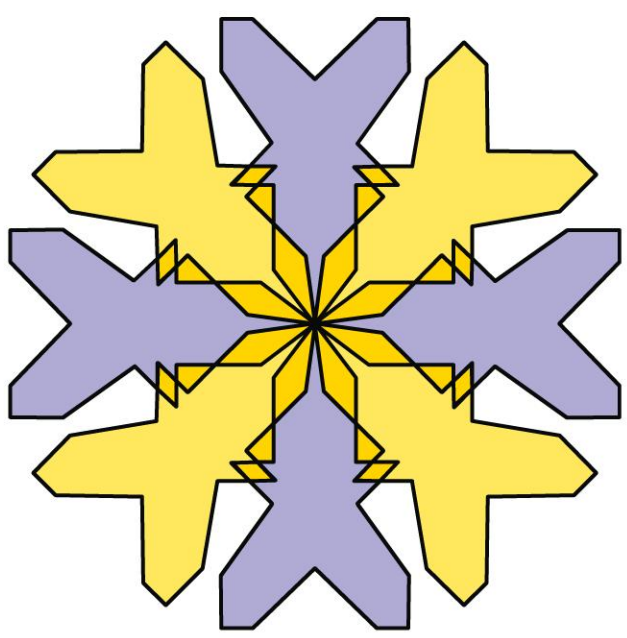

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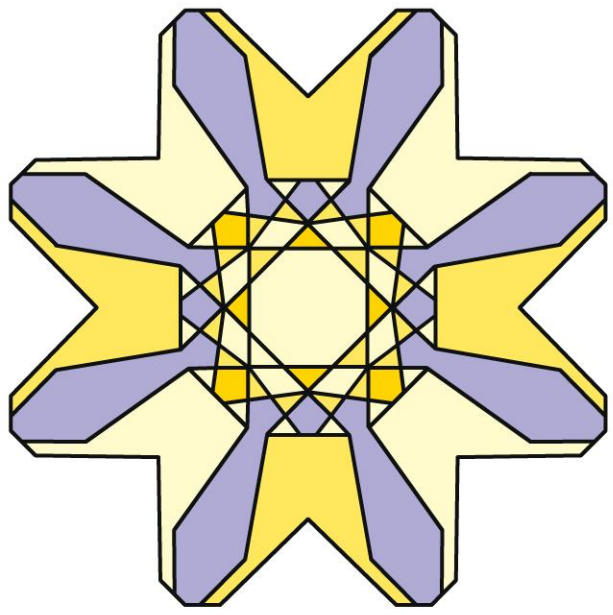

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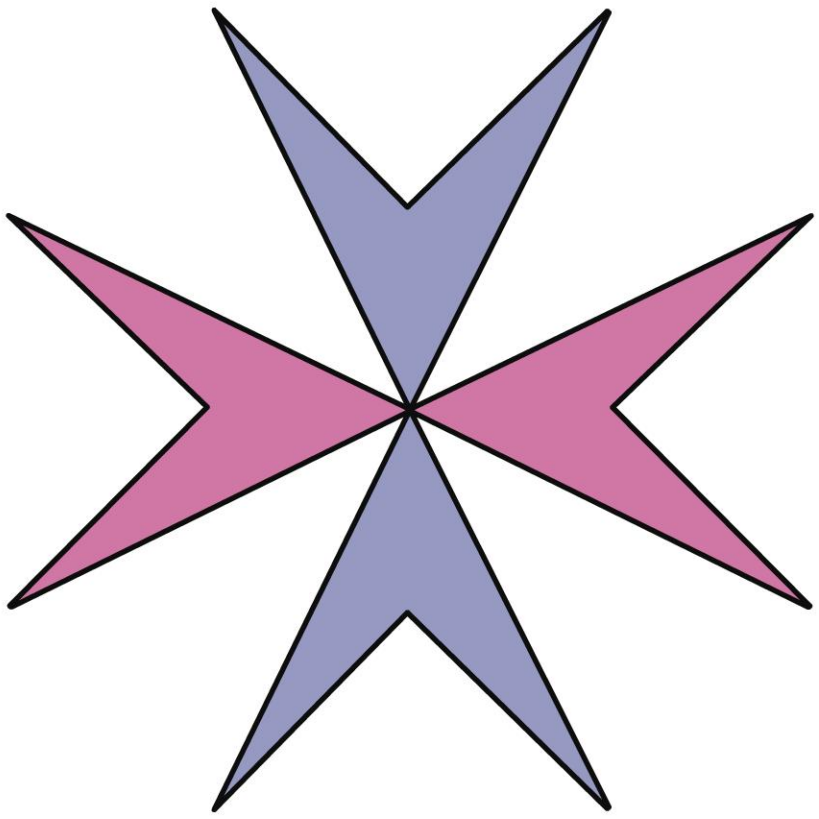
Chevrons



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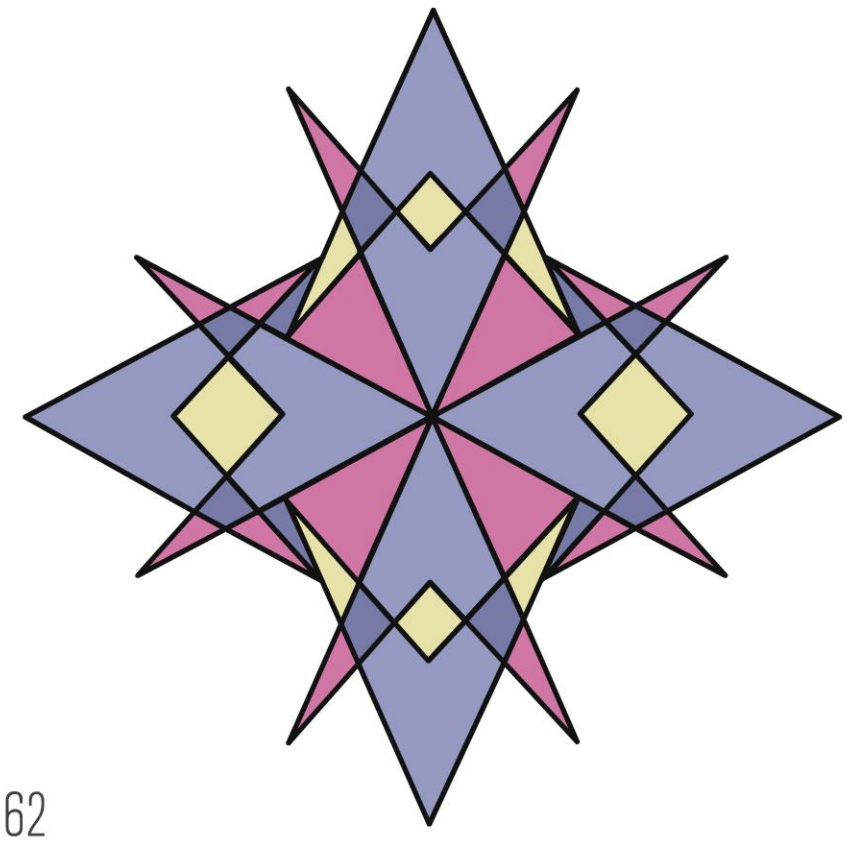

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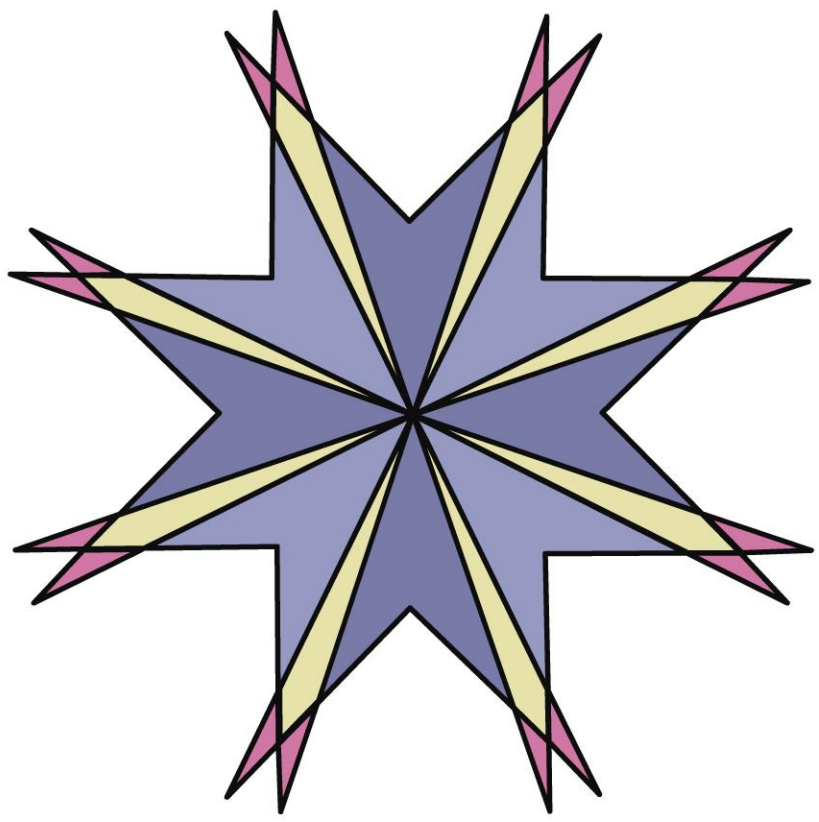

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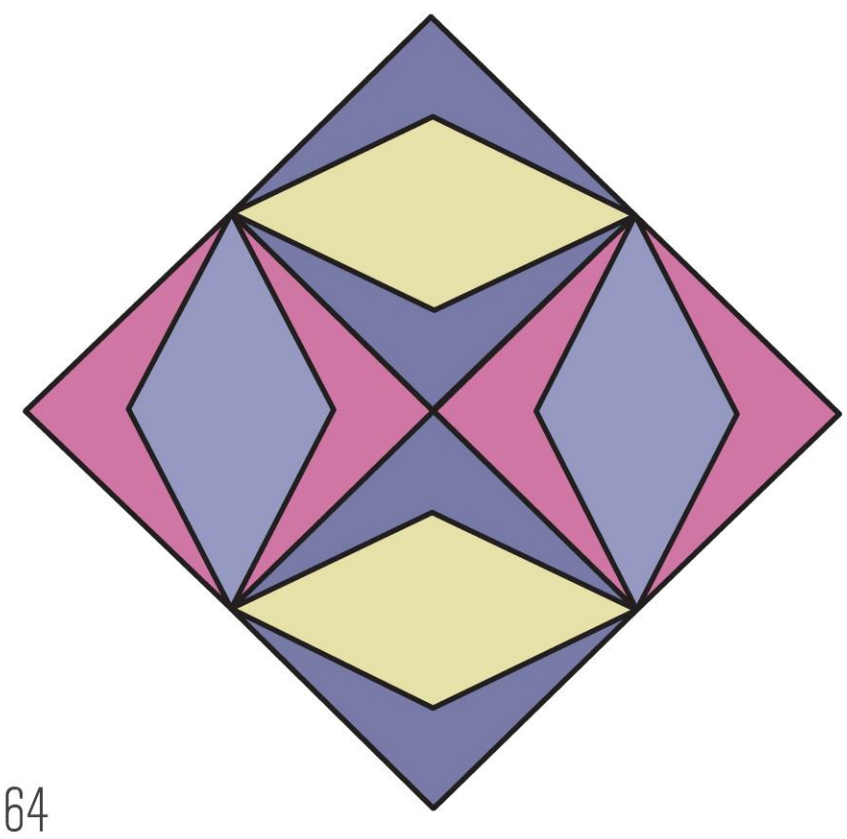

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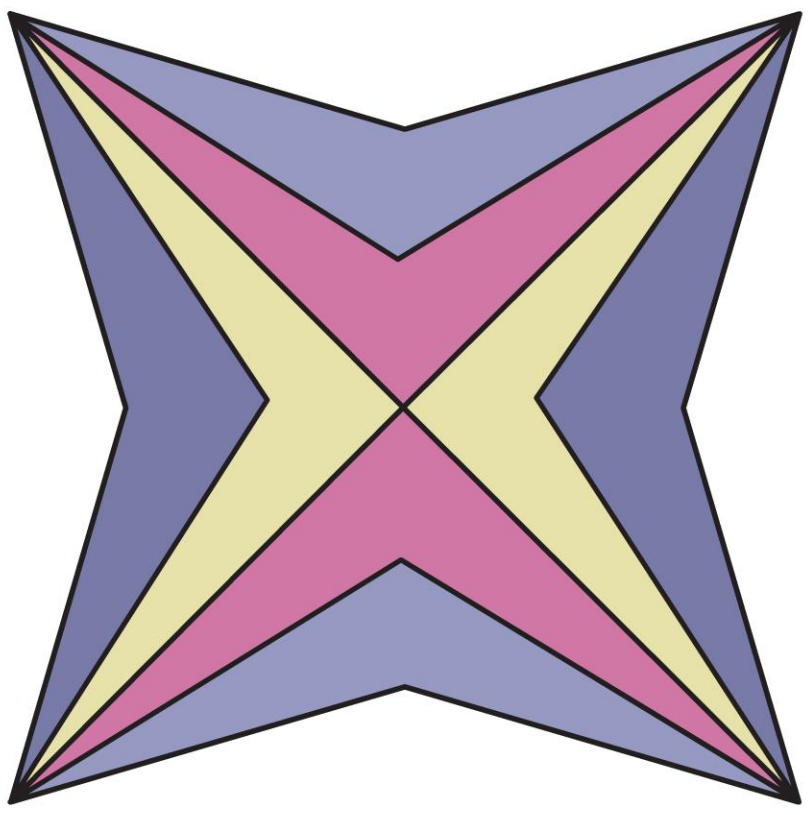

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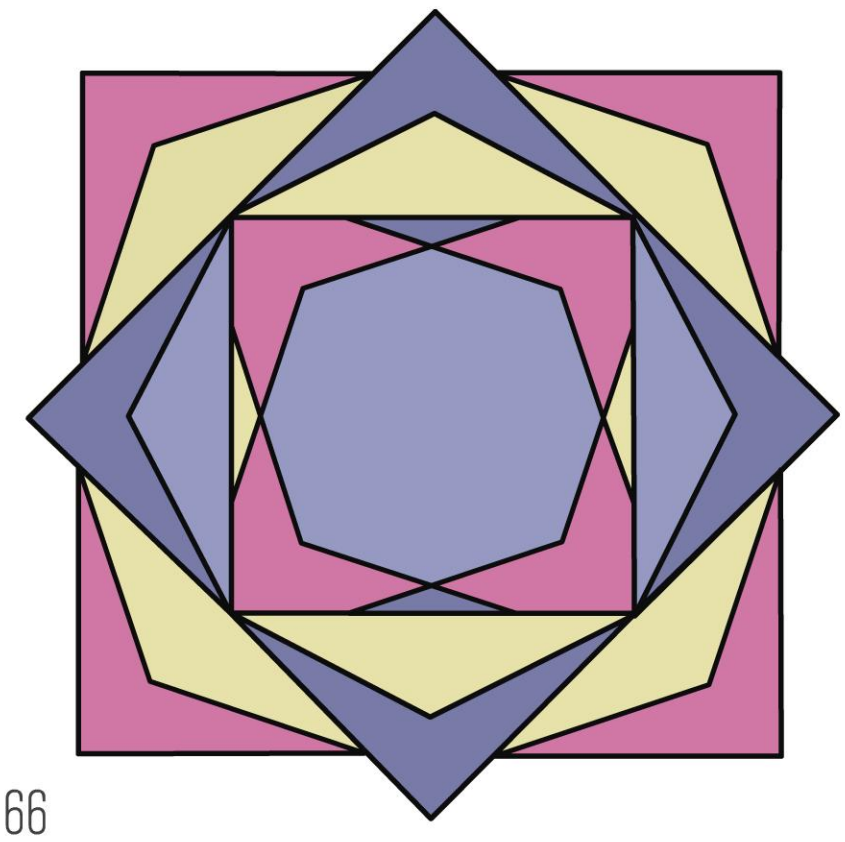

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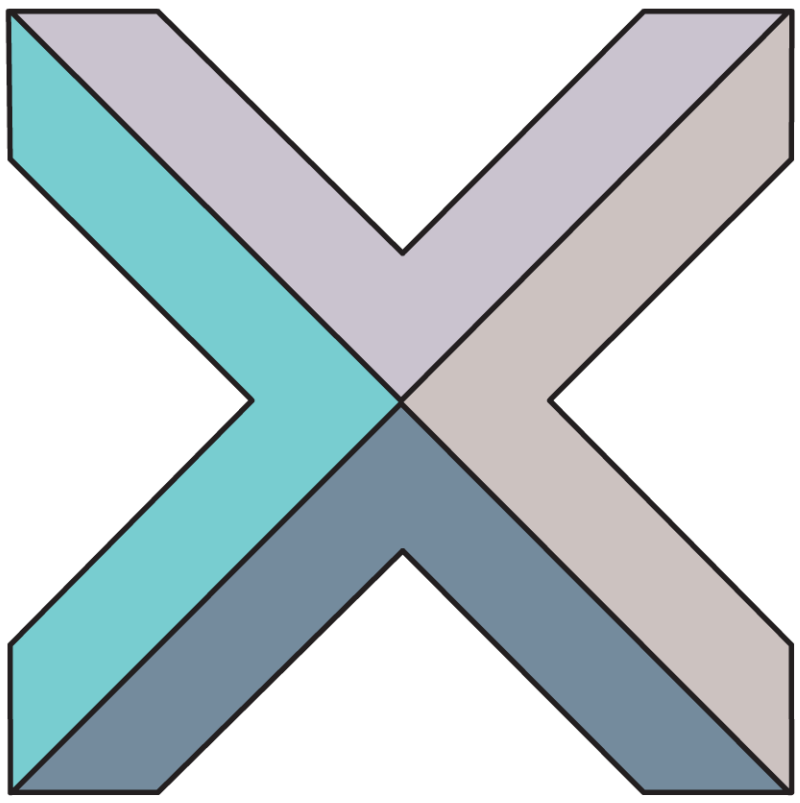
Chevrons 2



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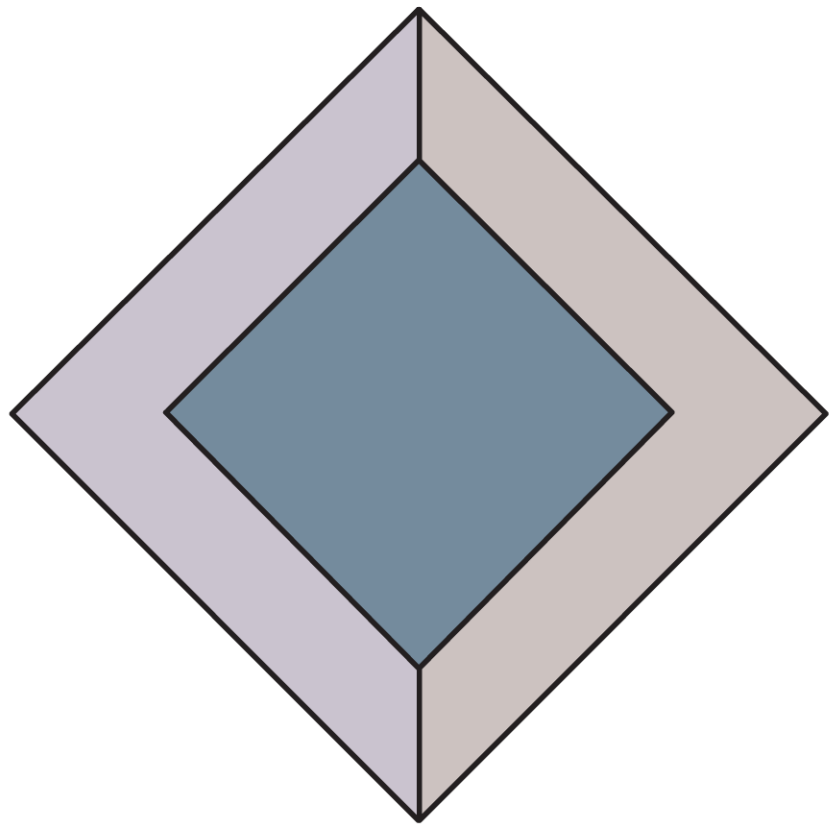

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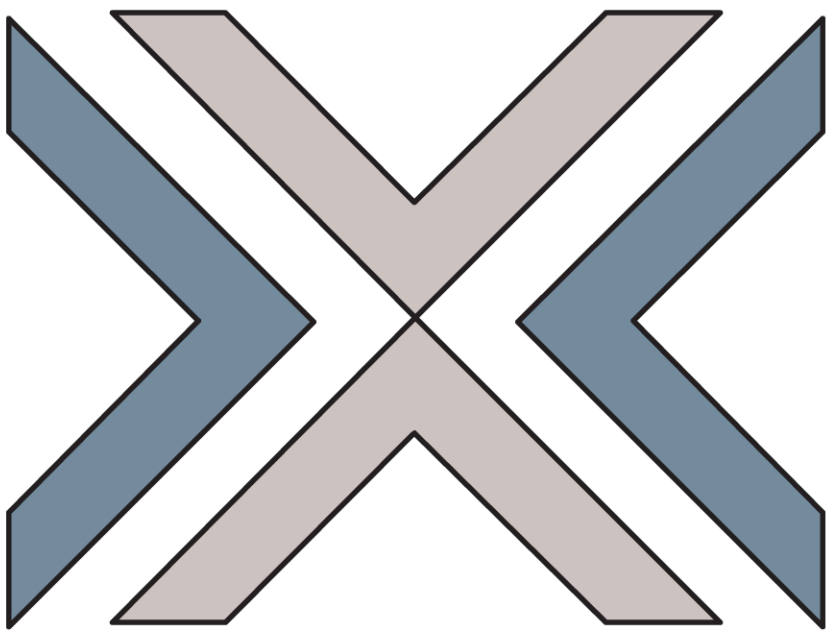

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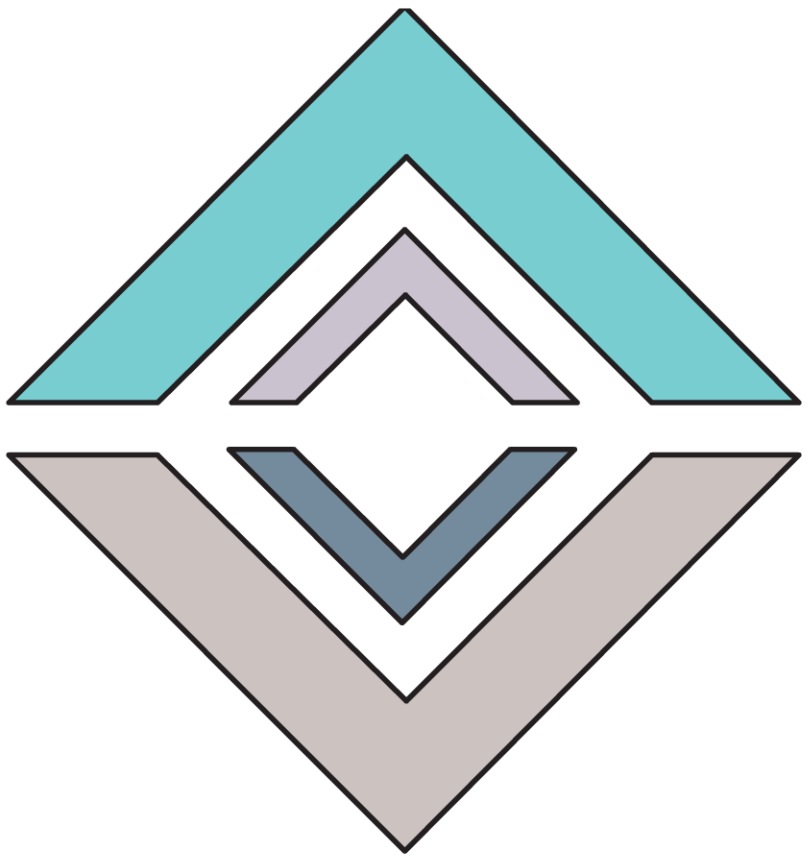

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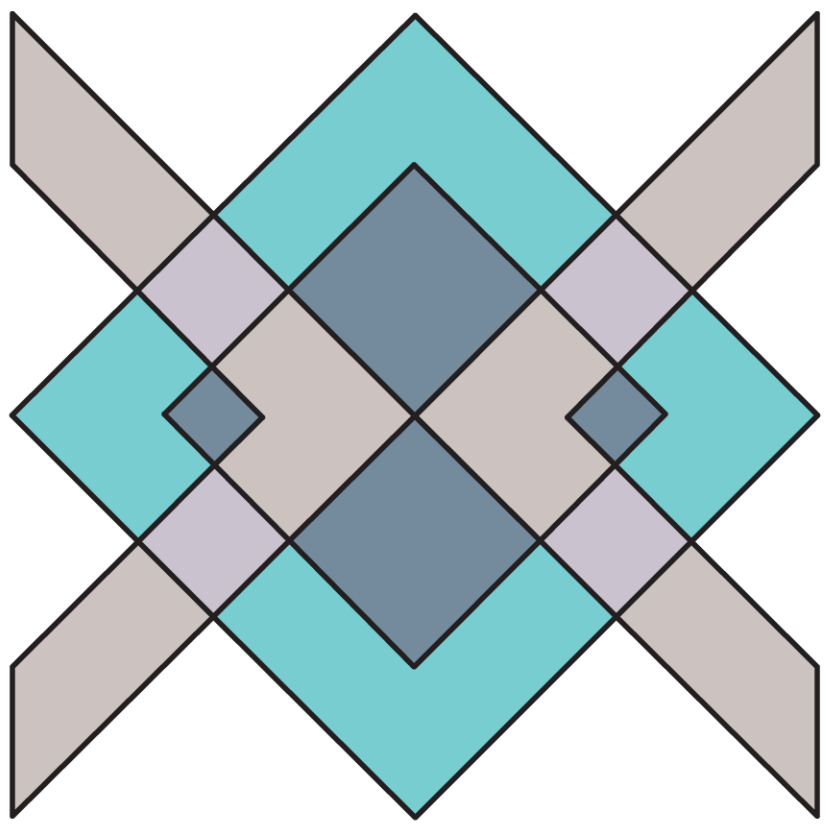

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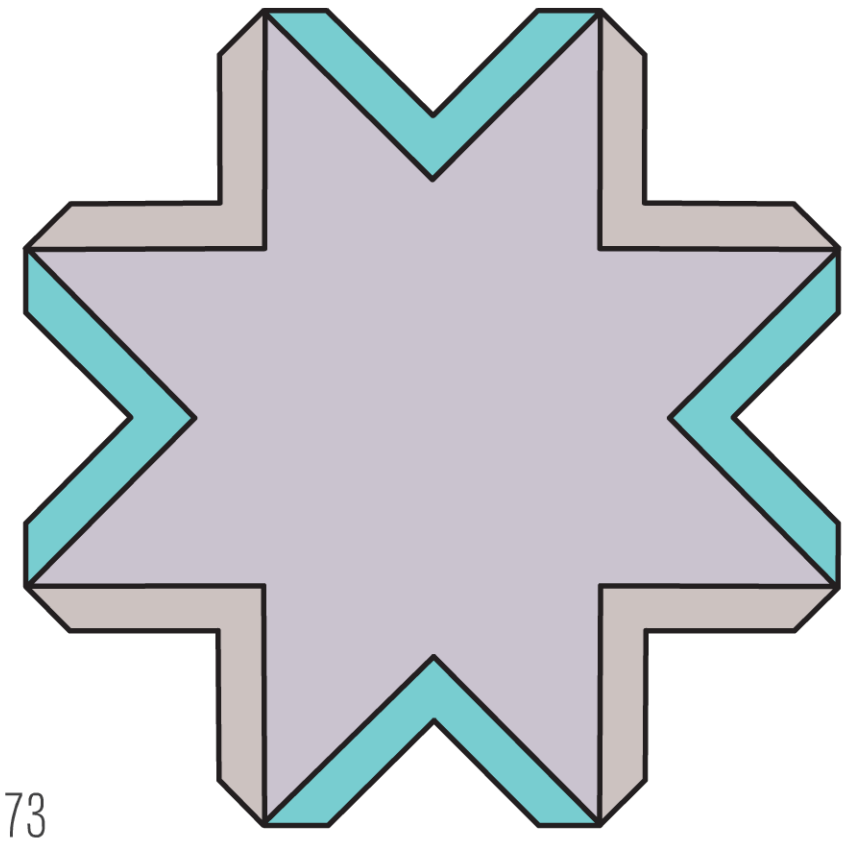

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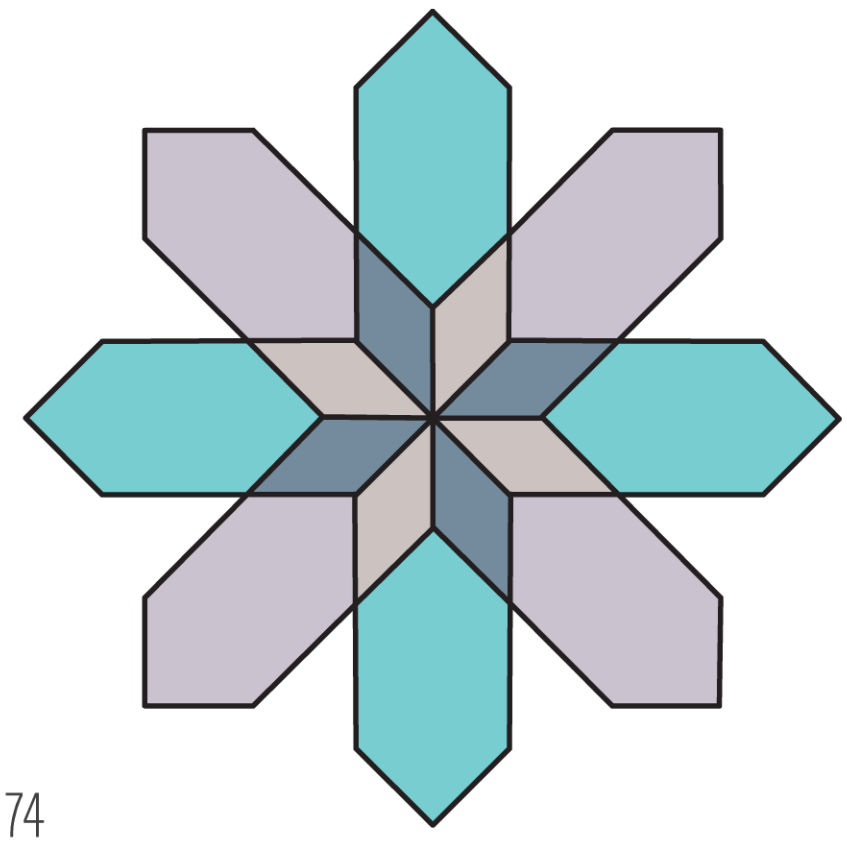

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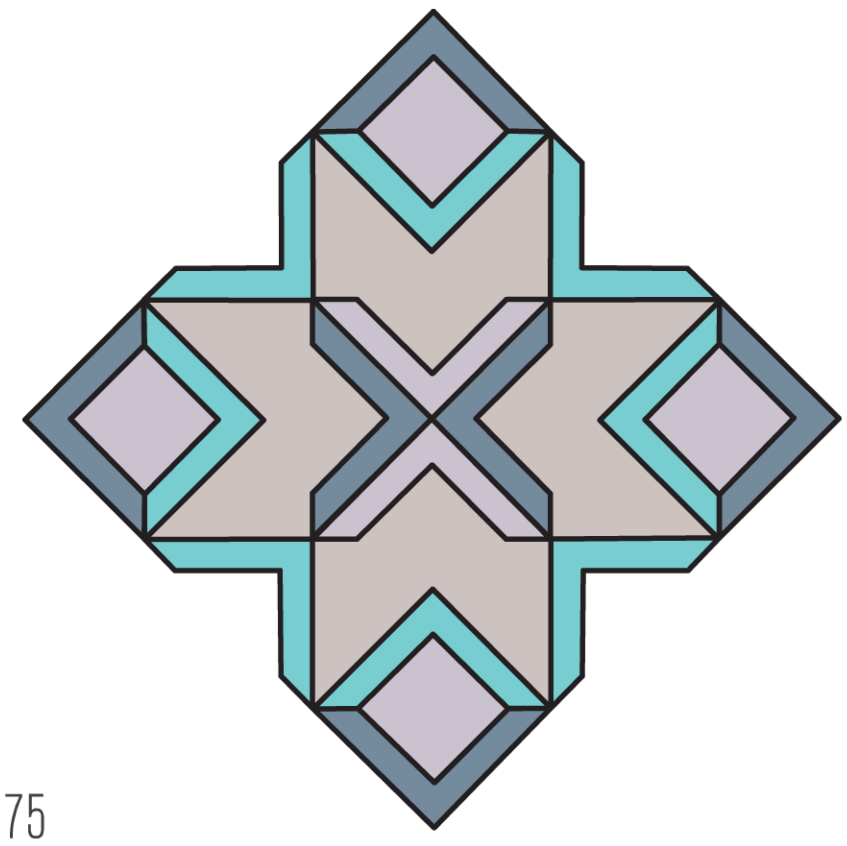

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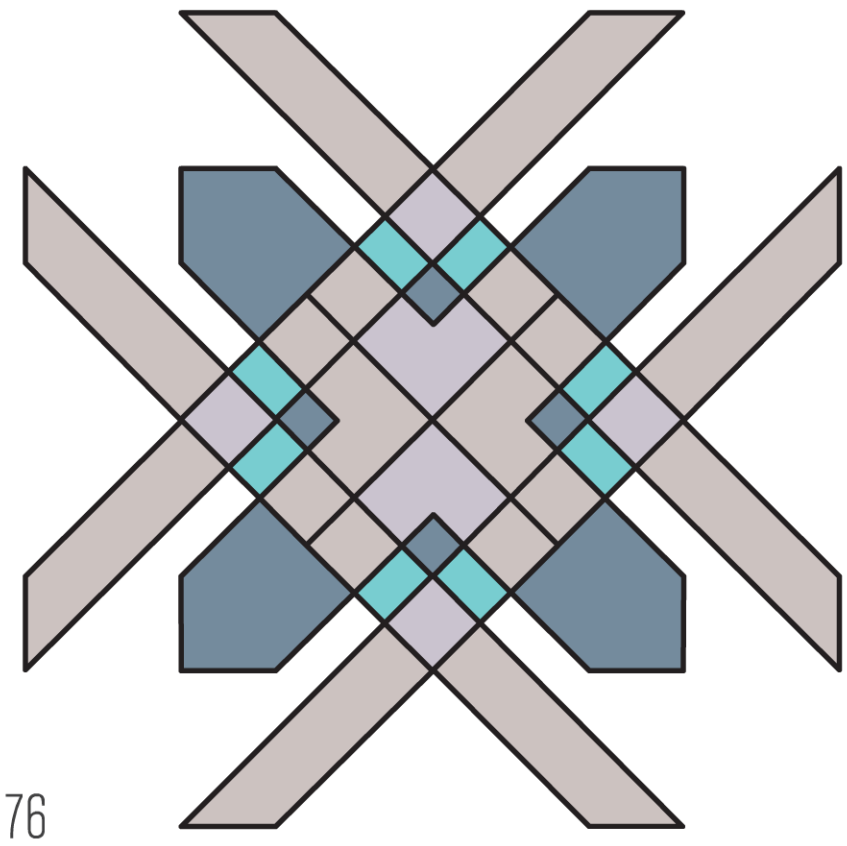

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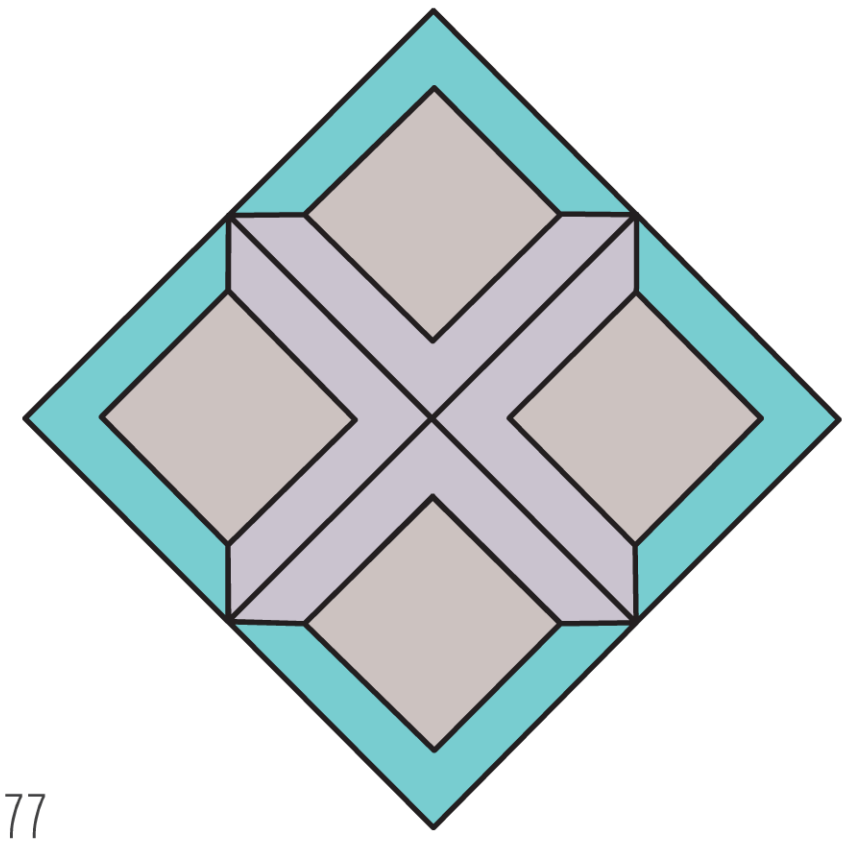

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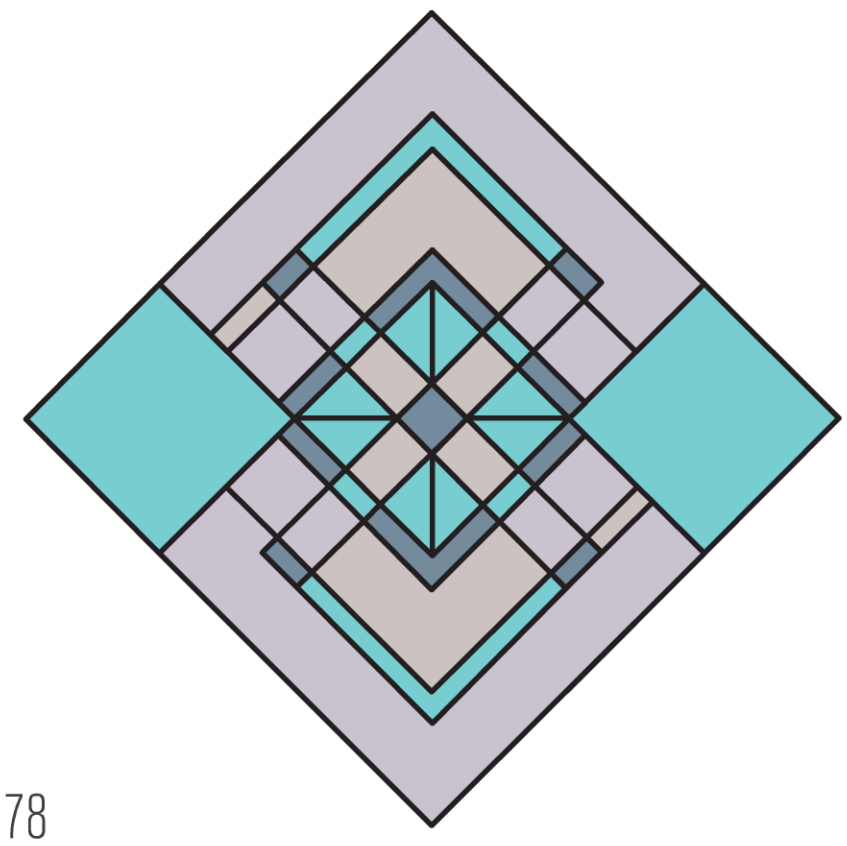

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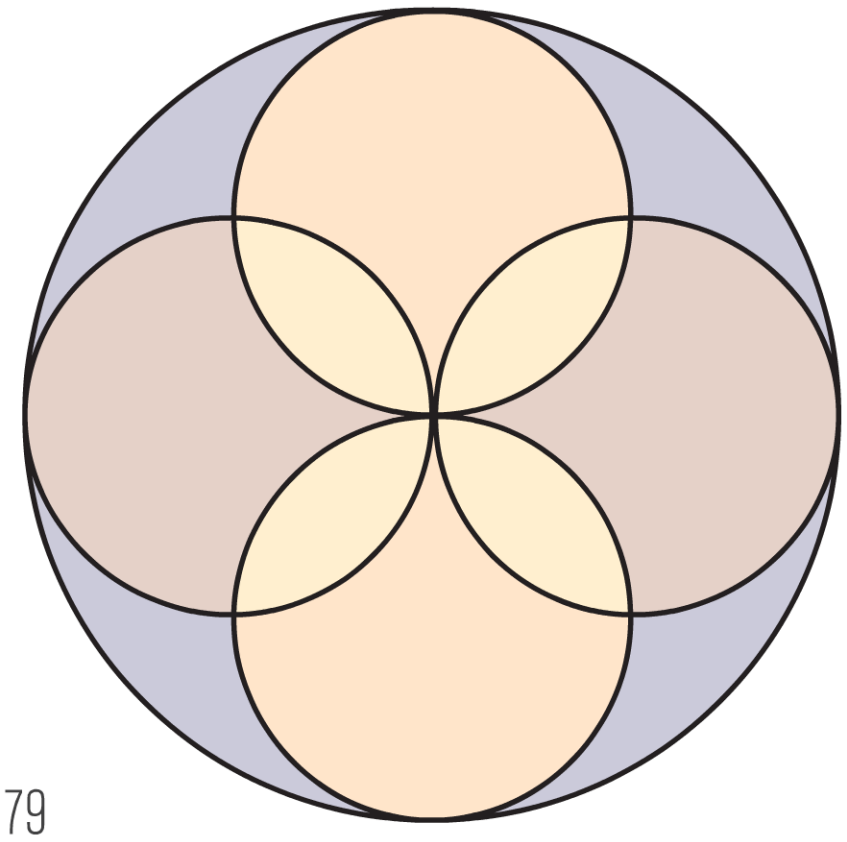

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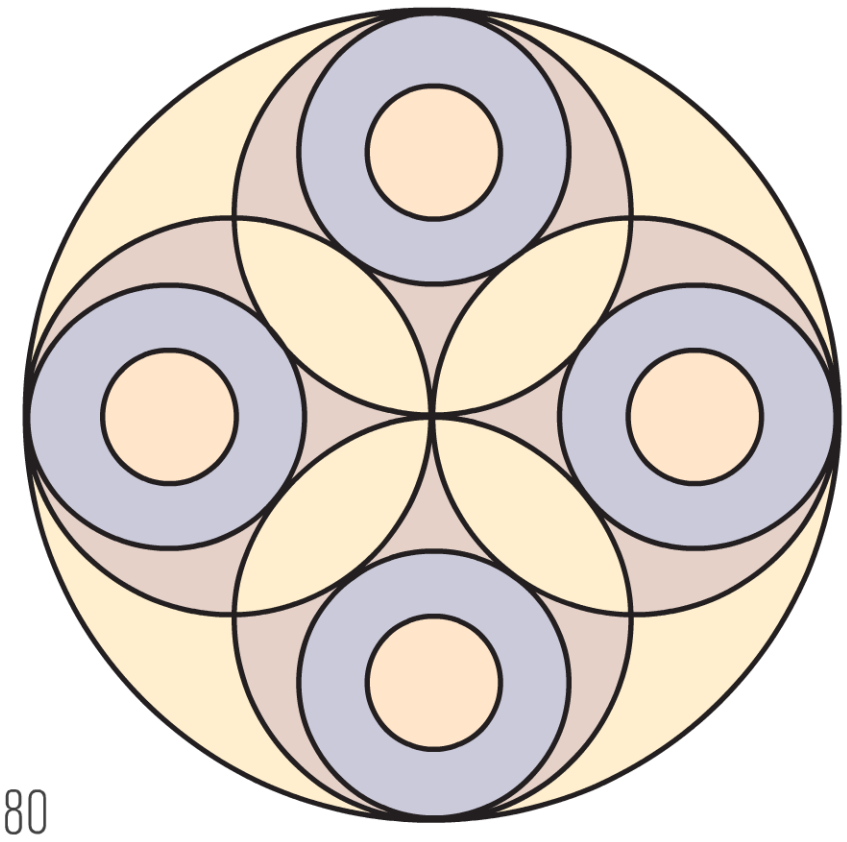

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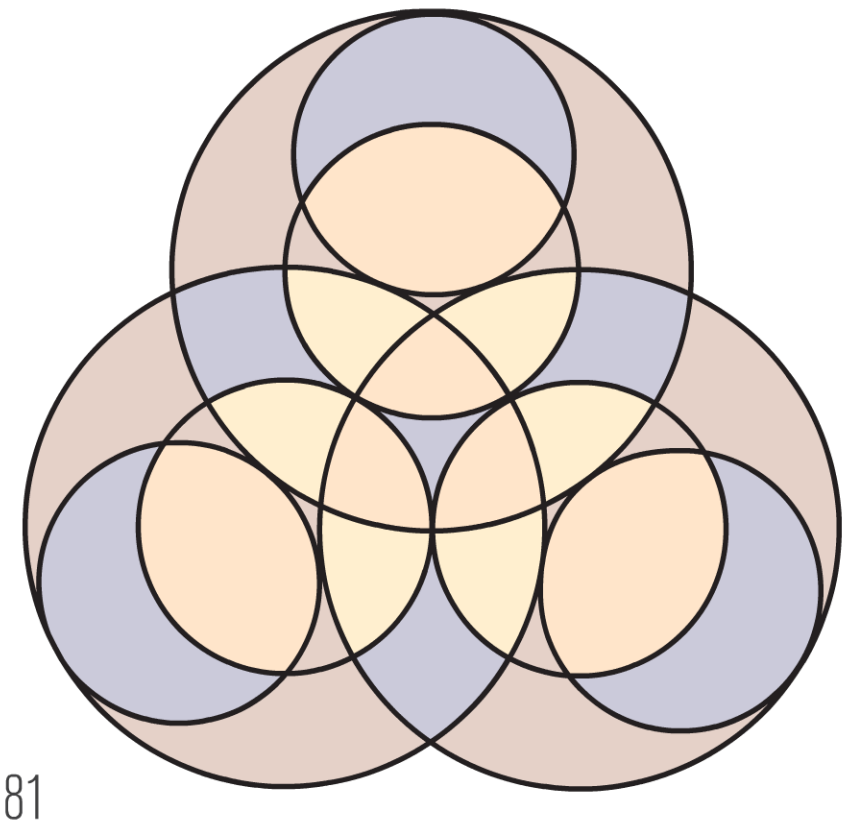

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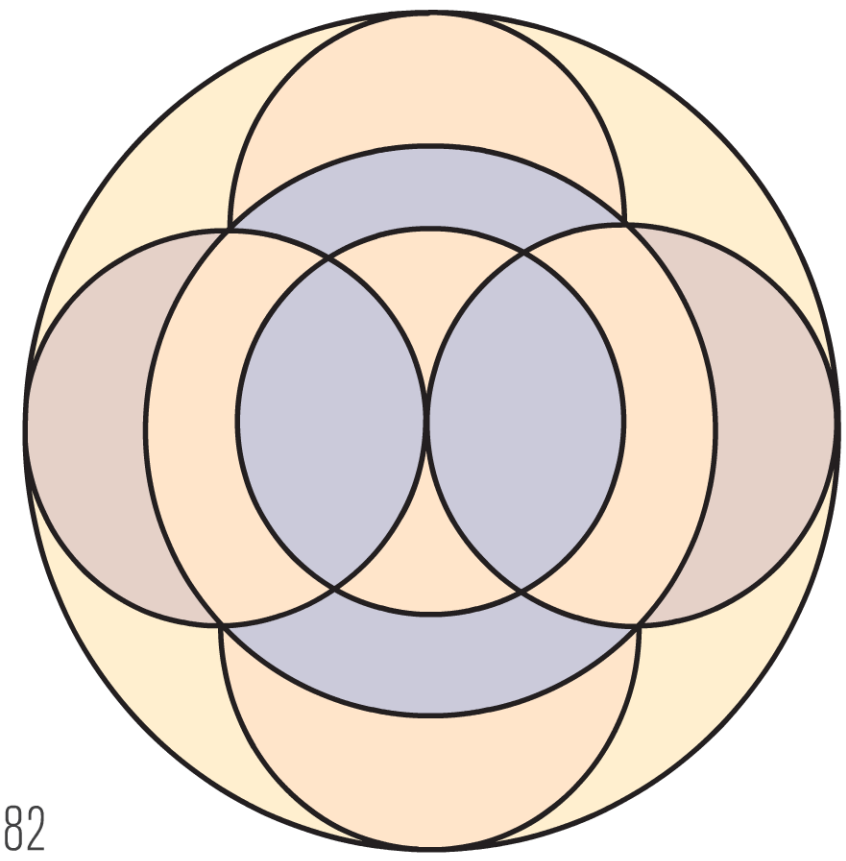

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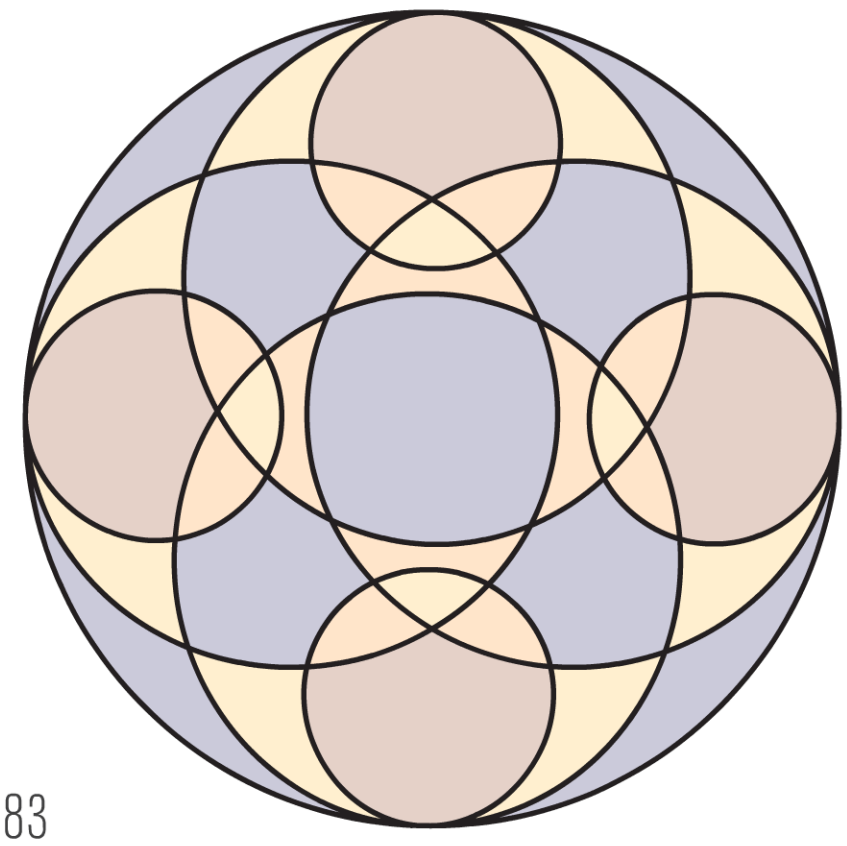

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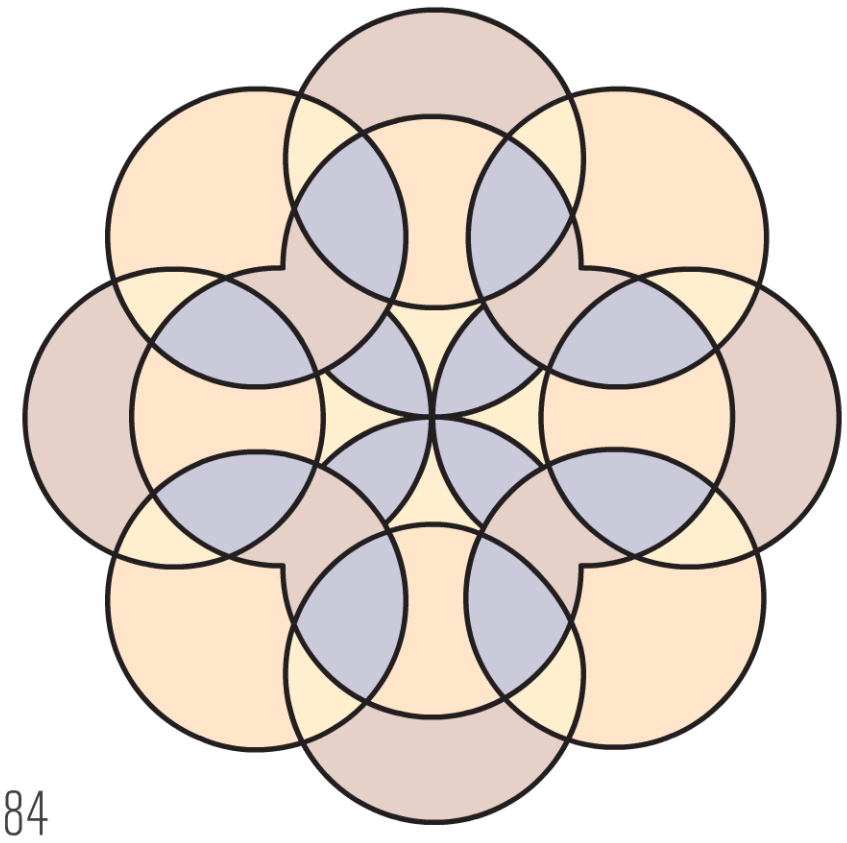

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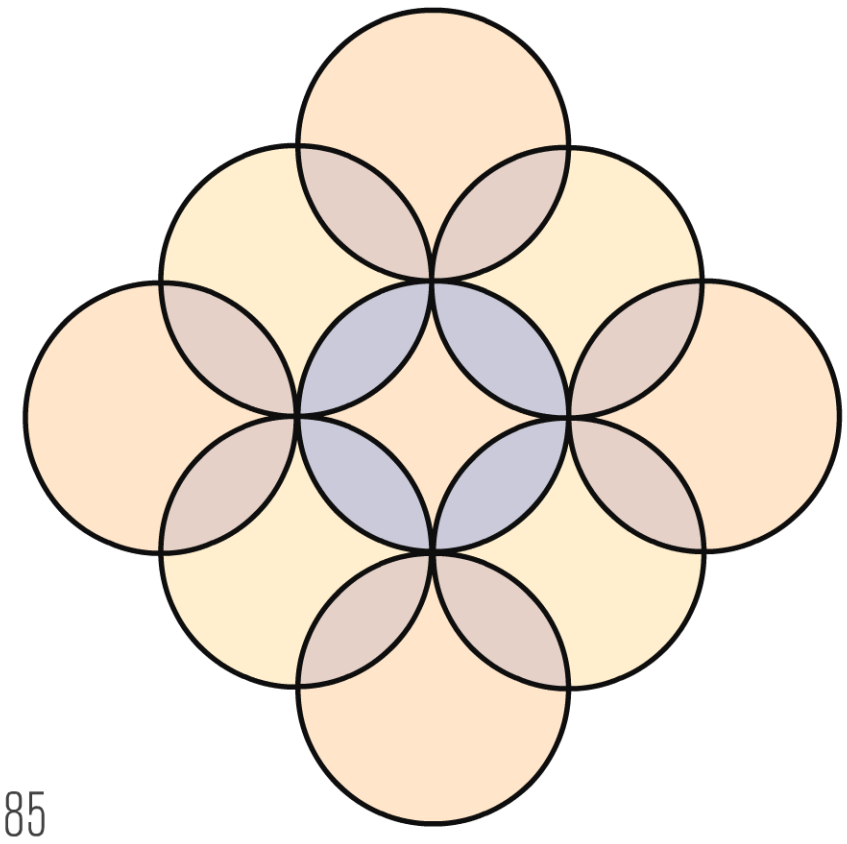

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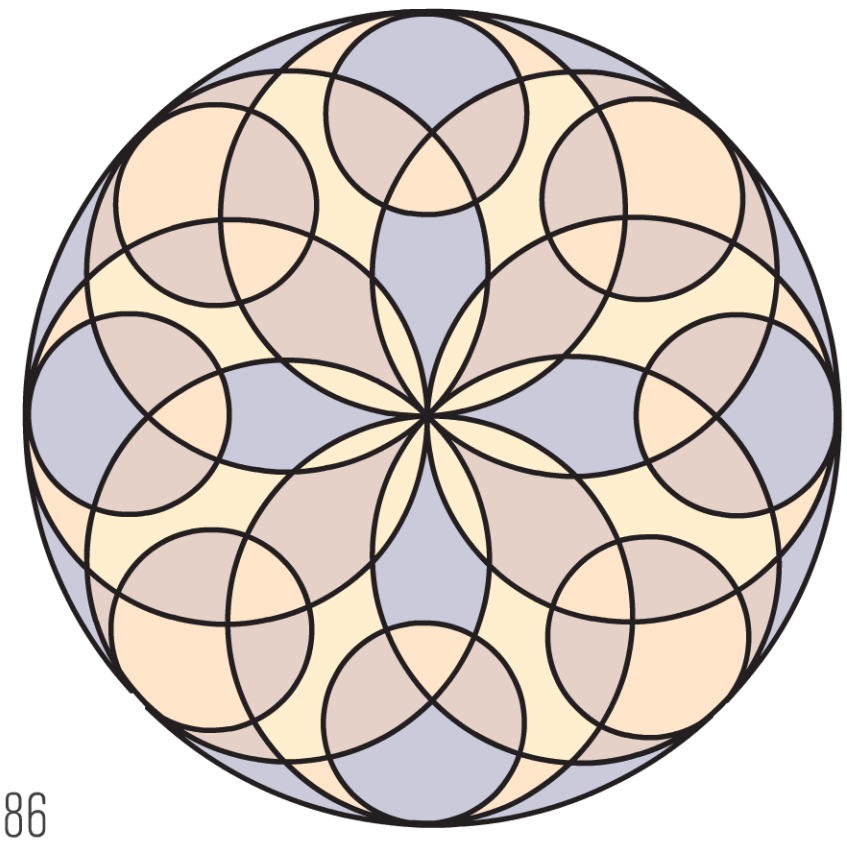

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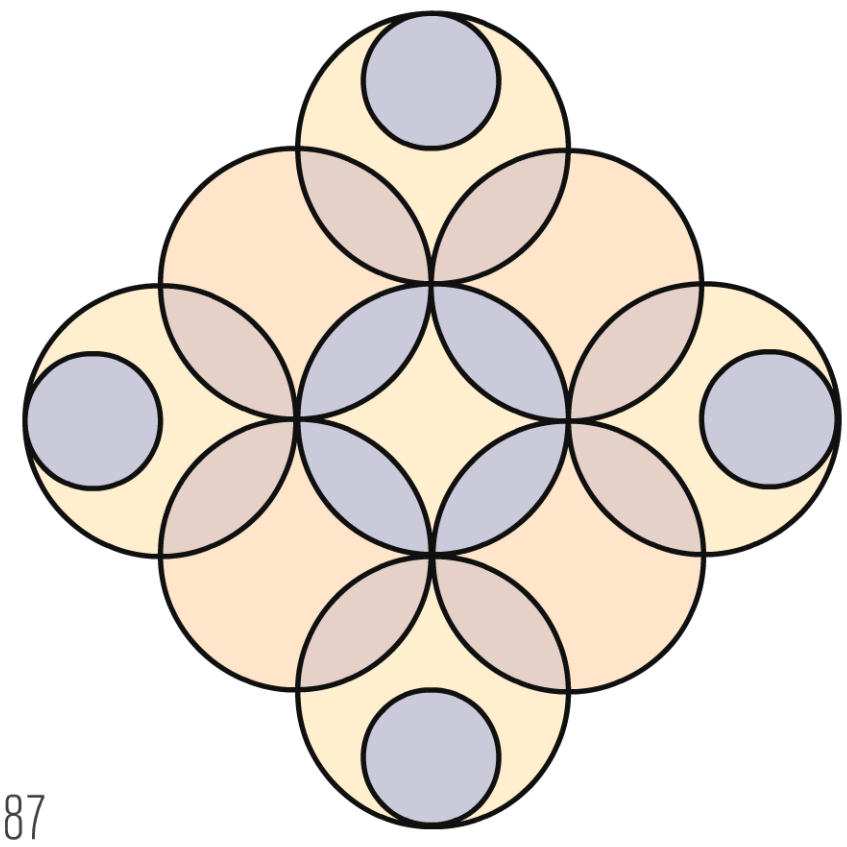

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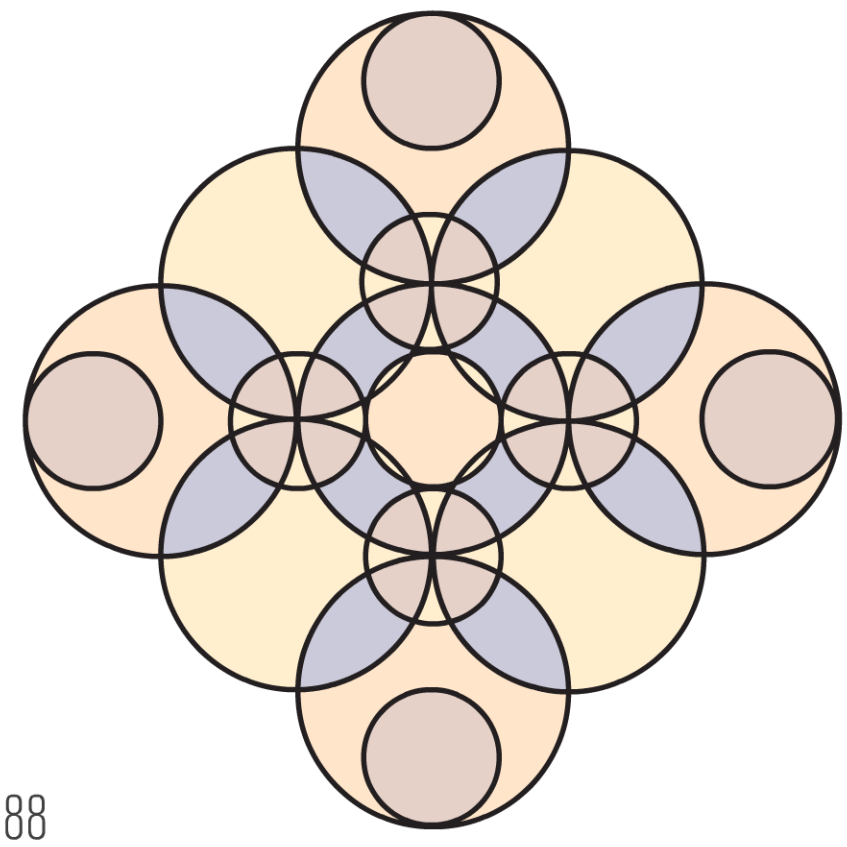

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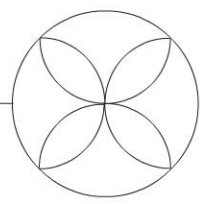
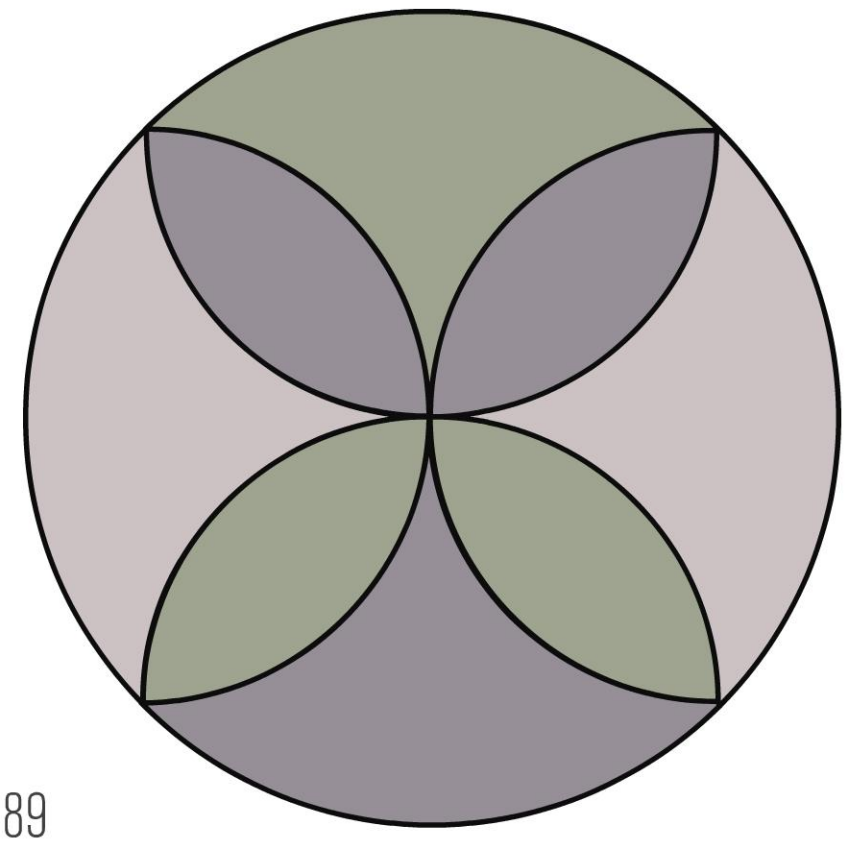


Circles & Curves



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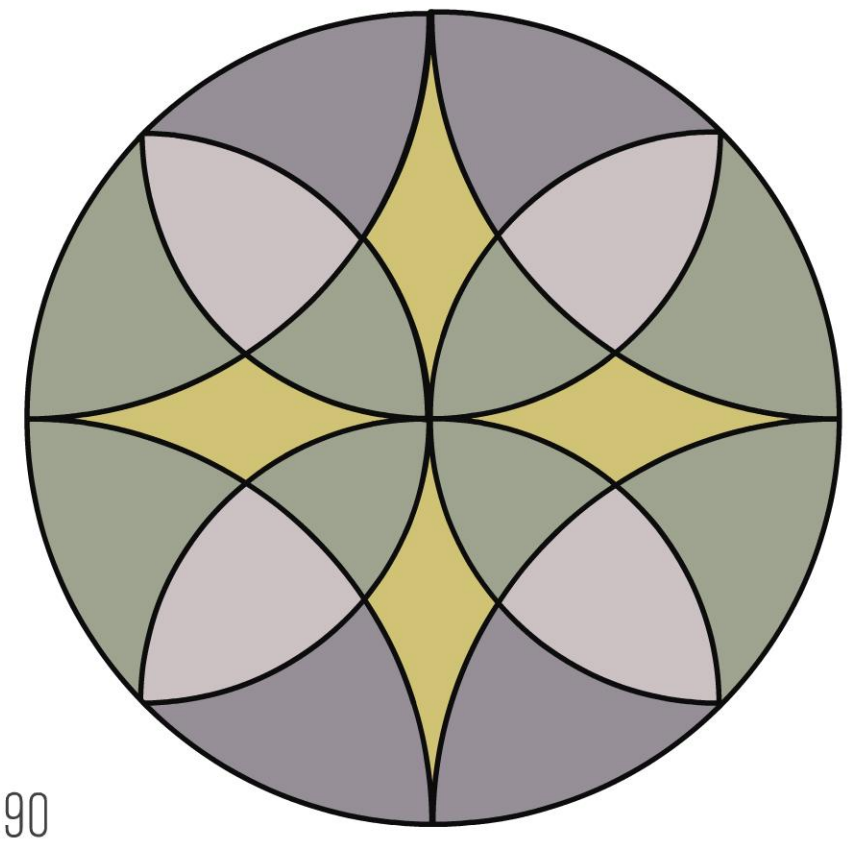

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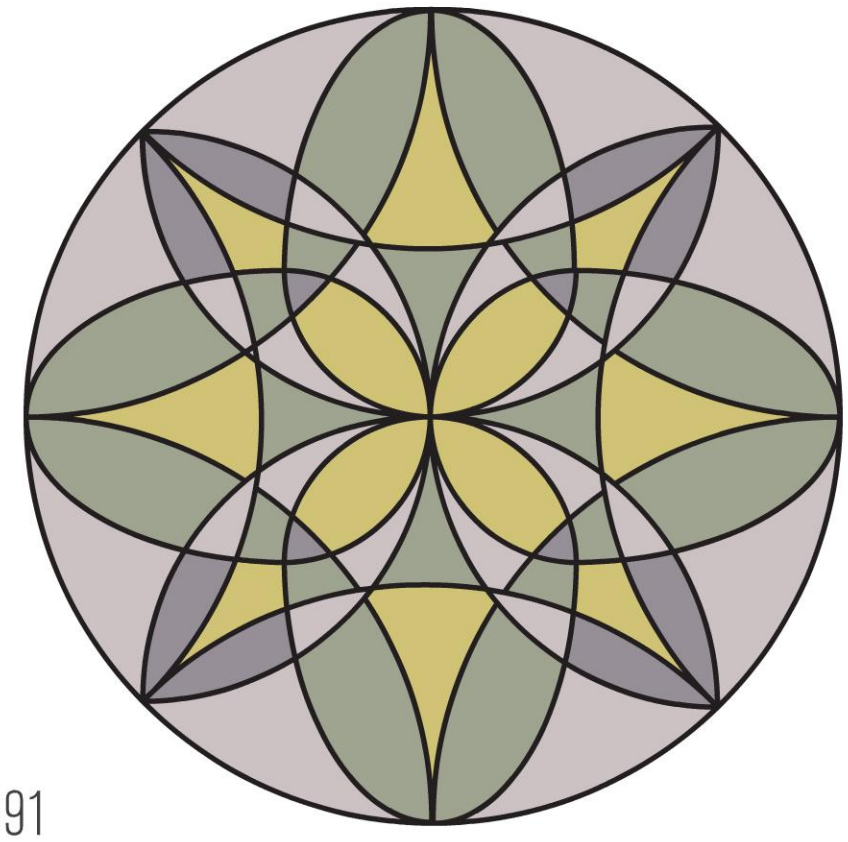

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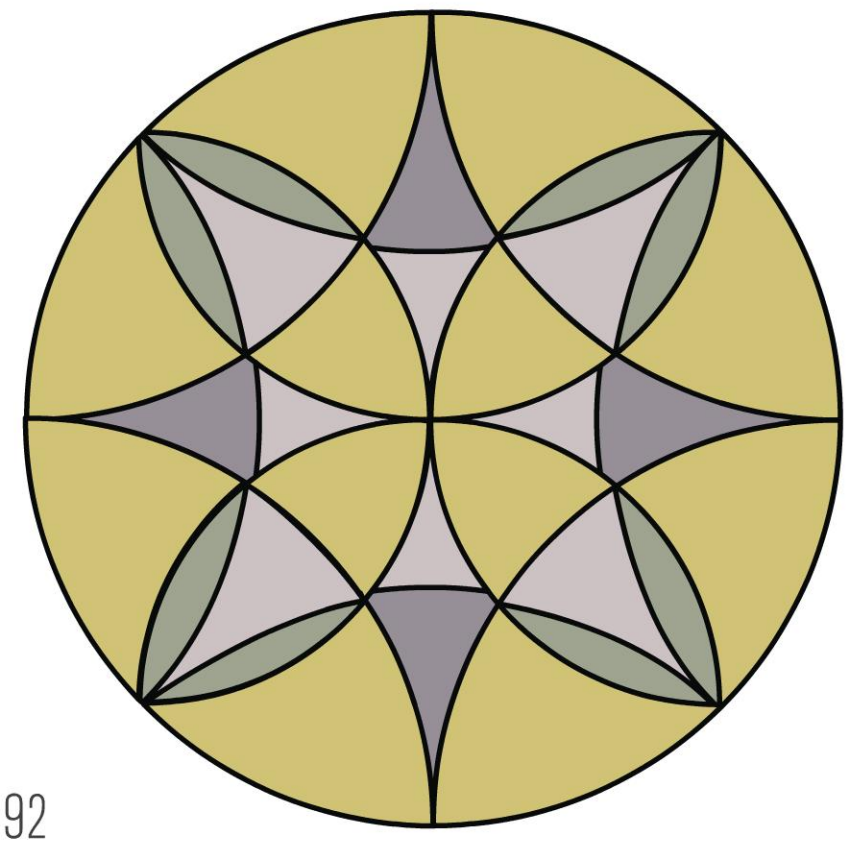

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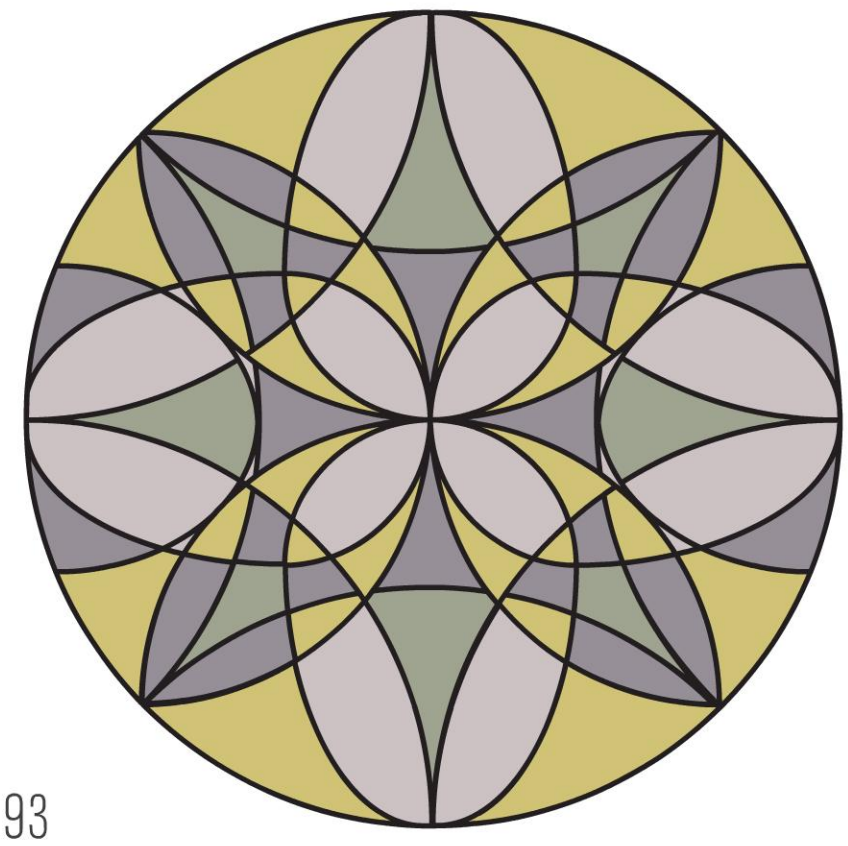

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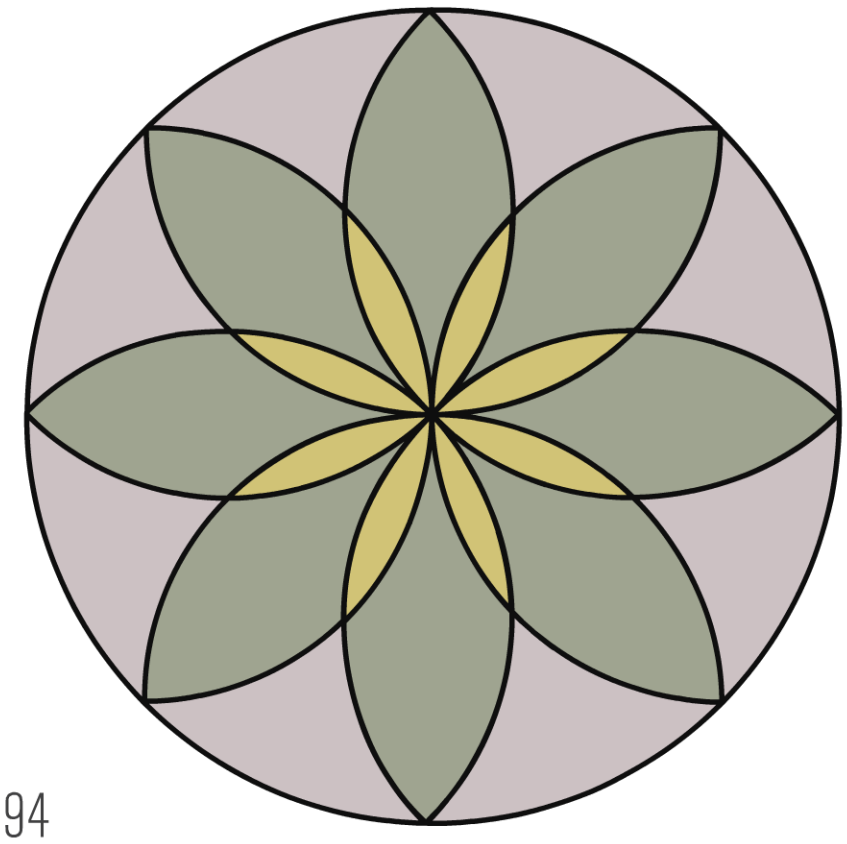

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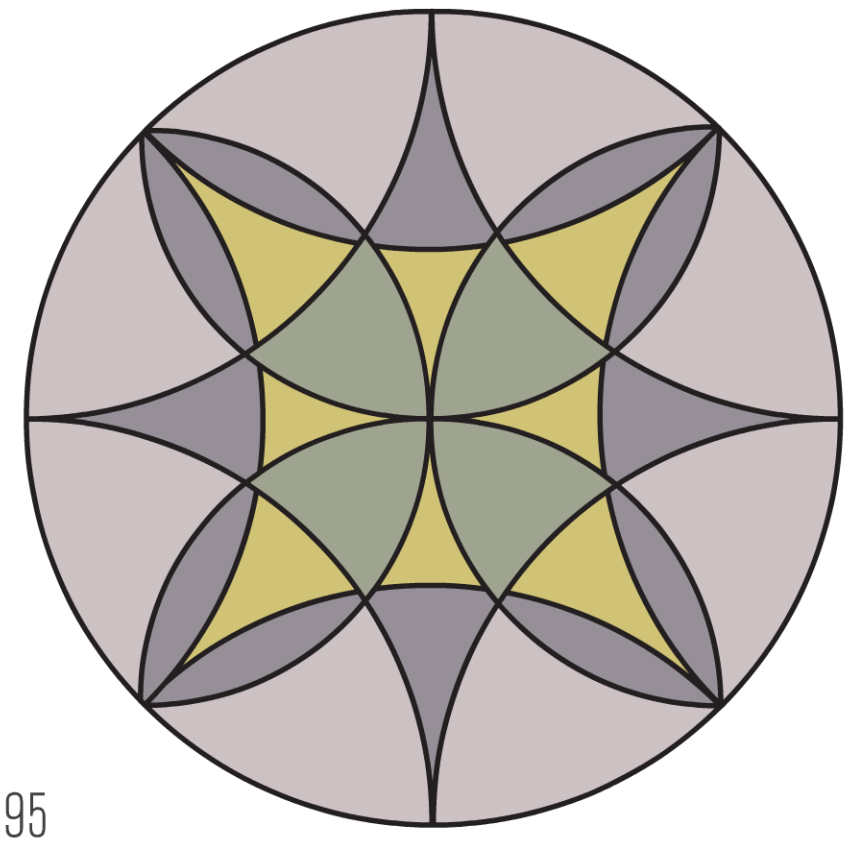

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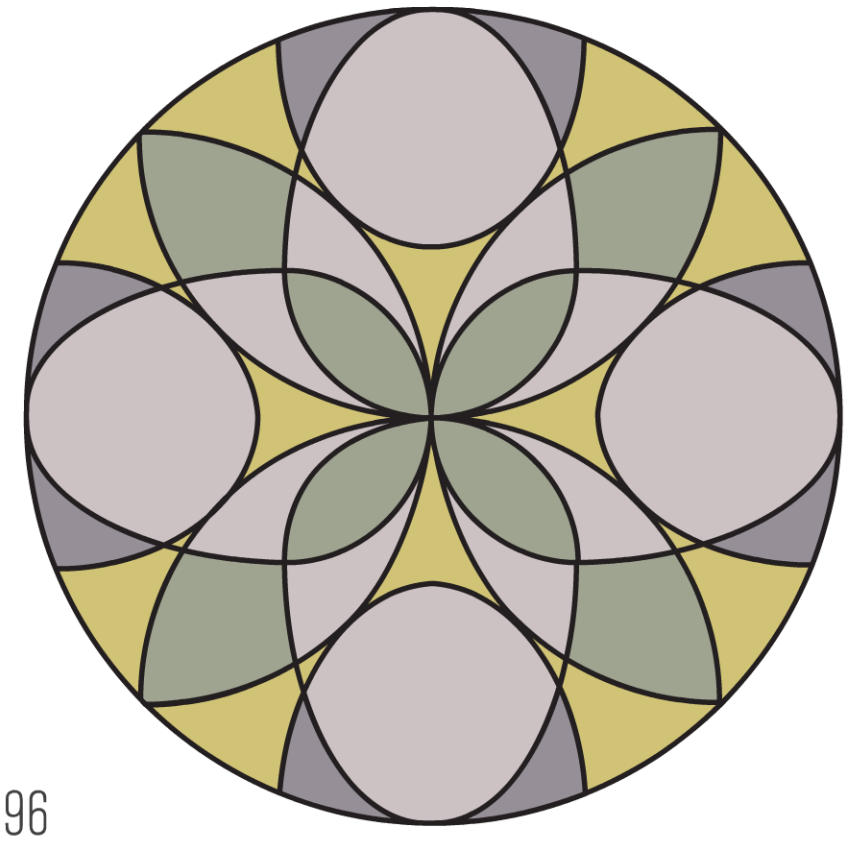

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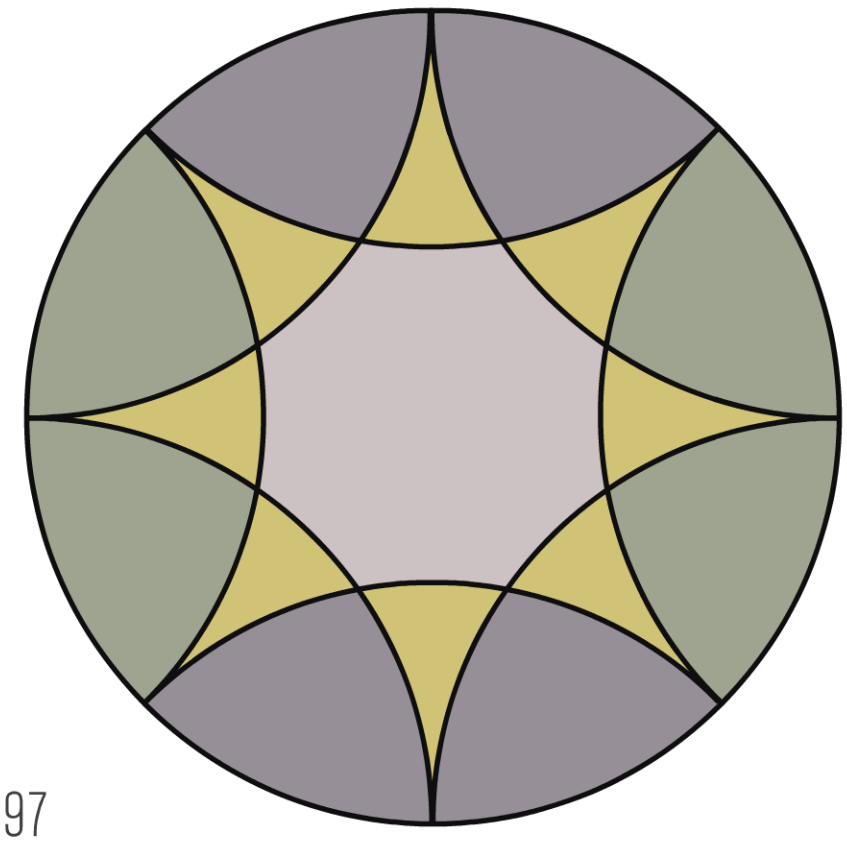

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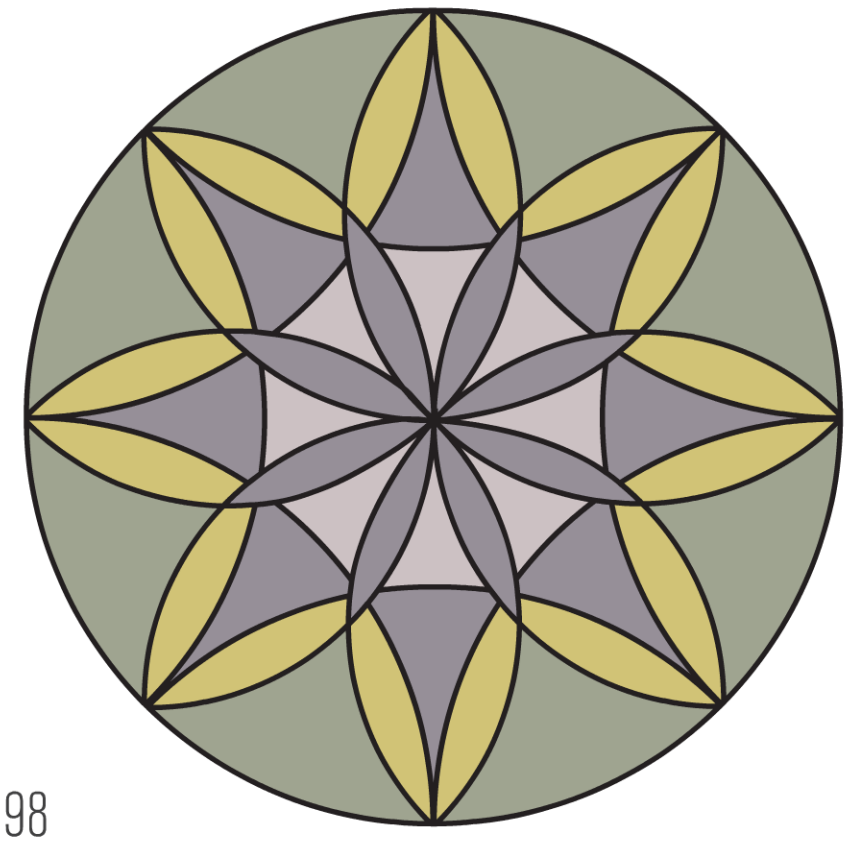

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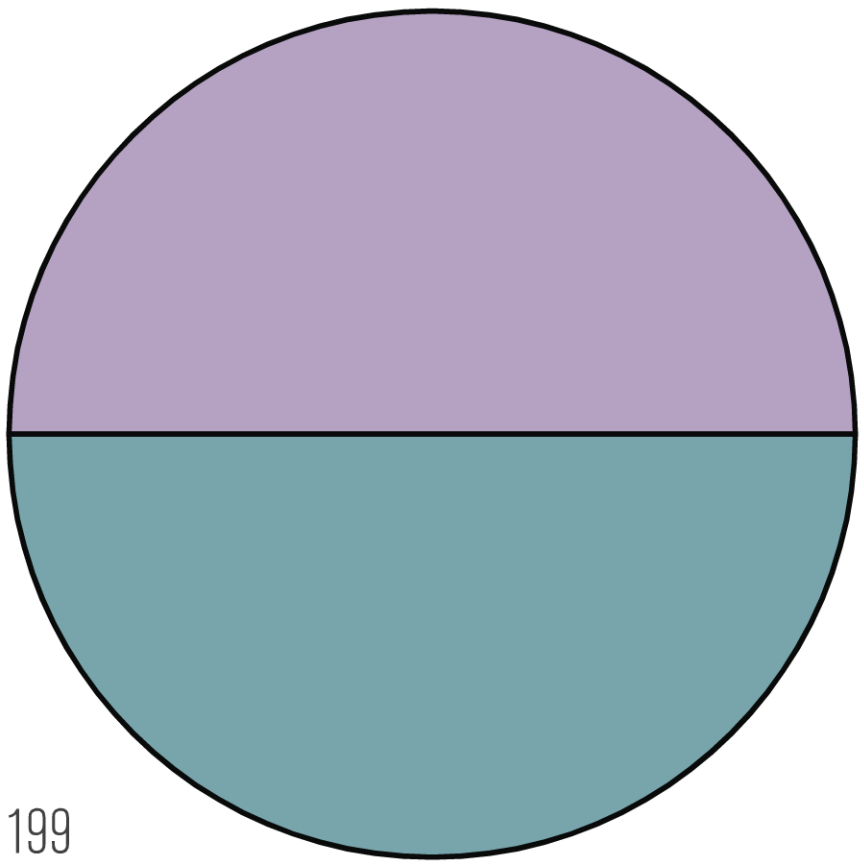
Circles Divided



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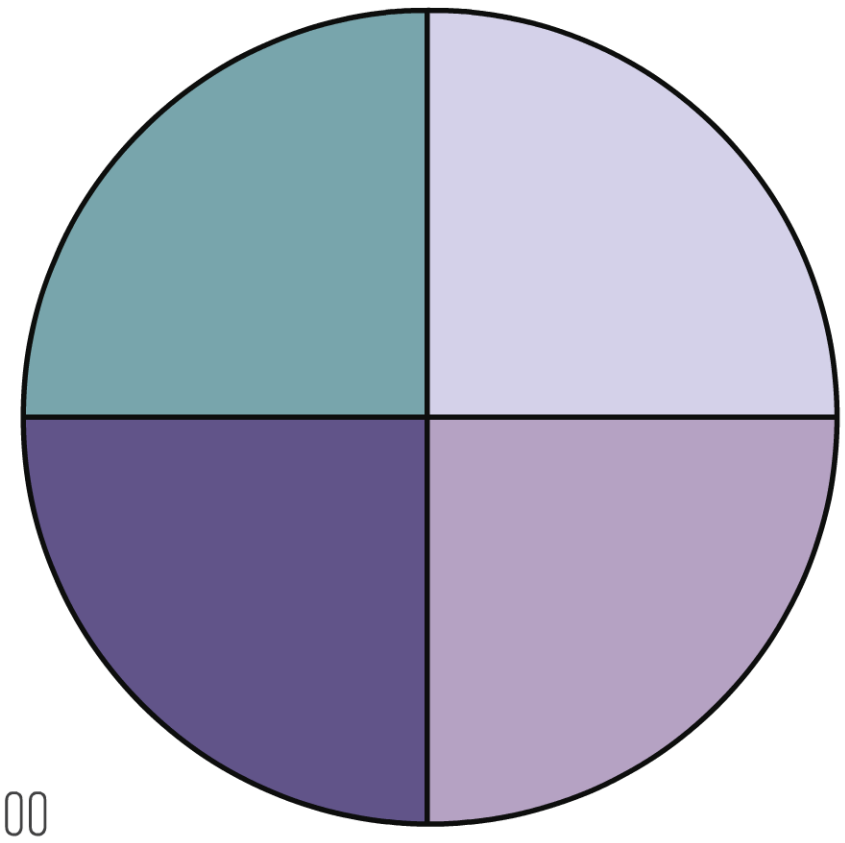

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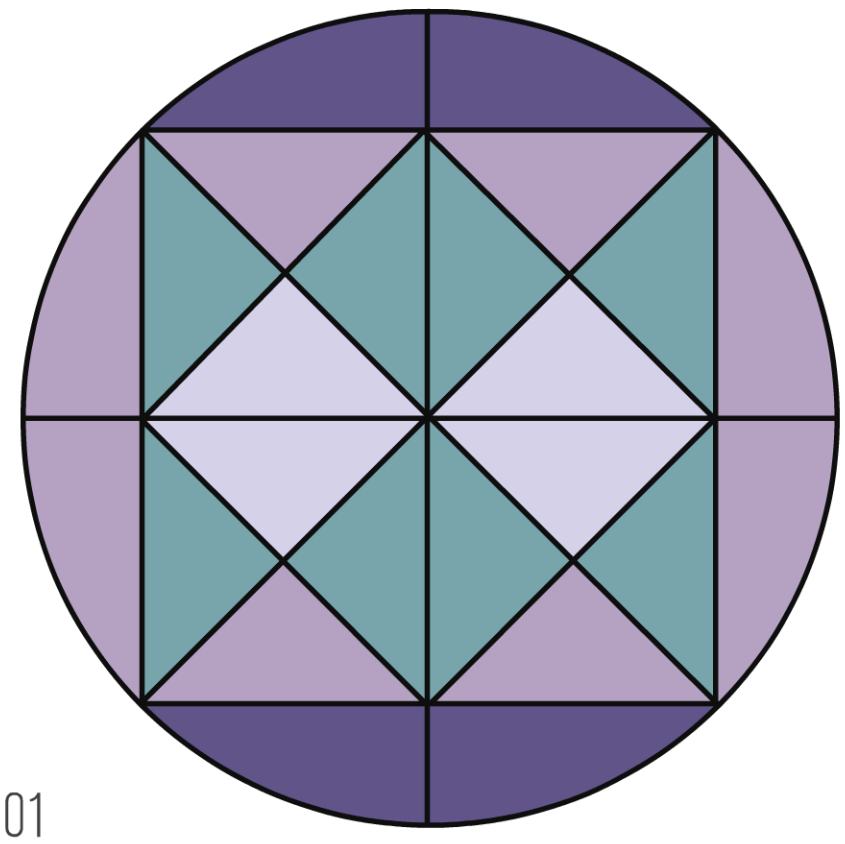

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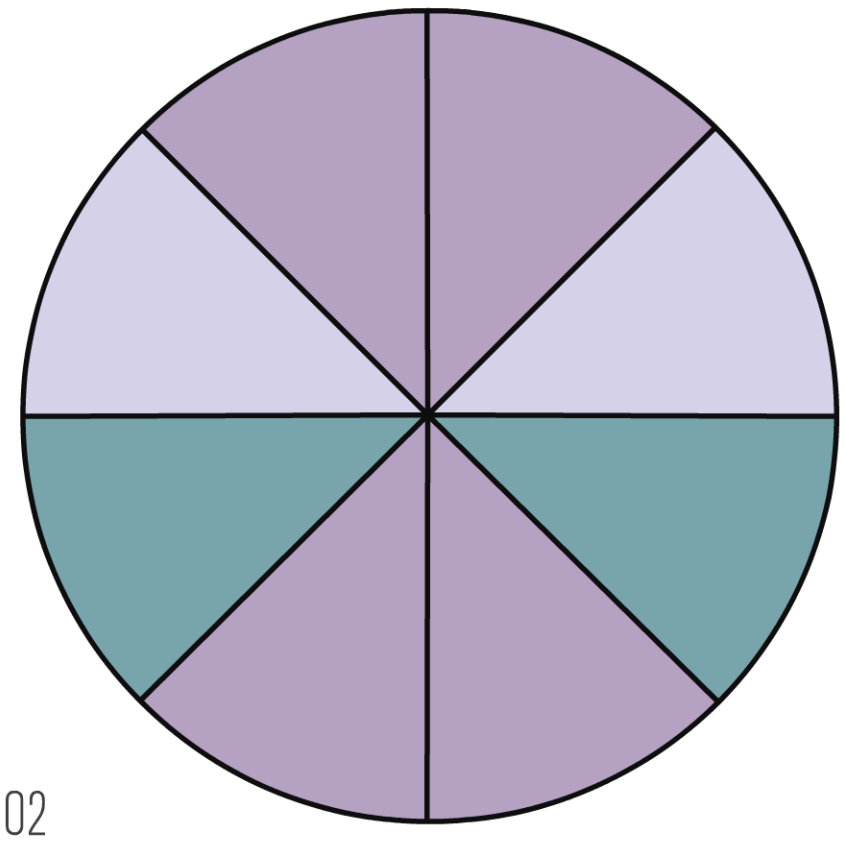

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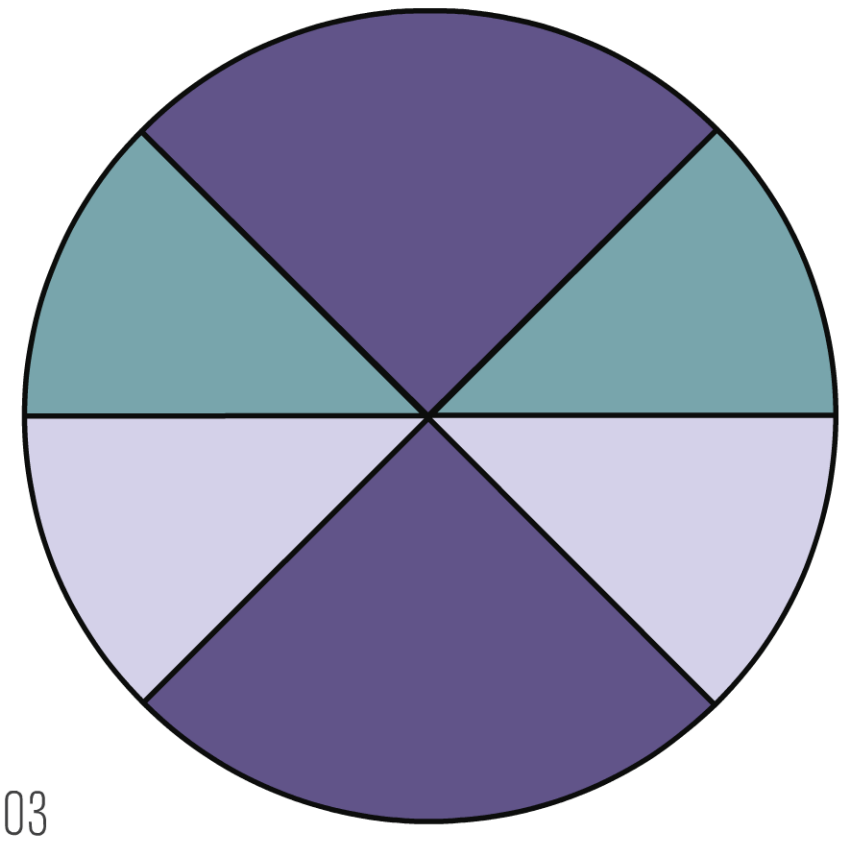

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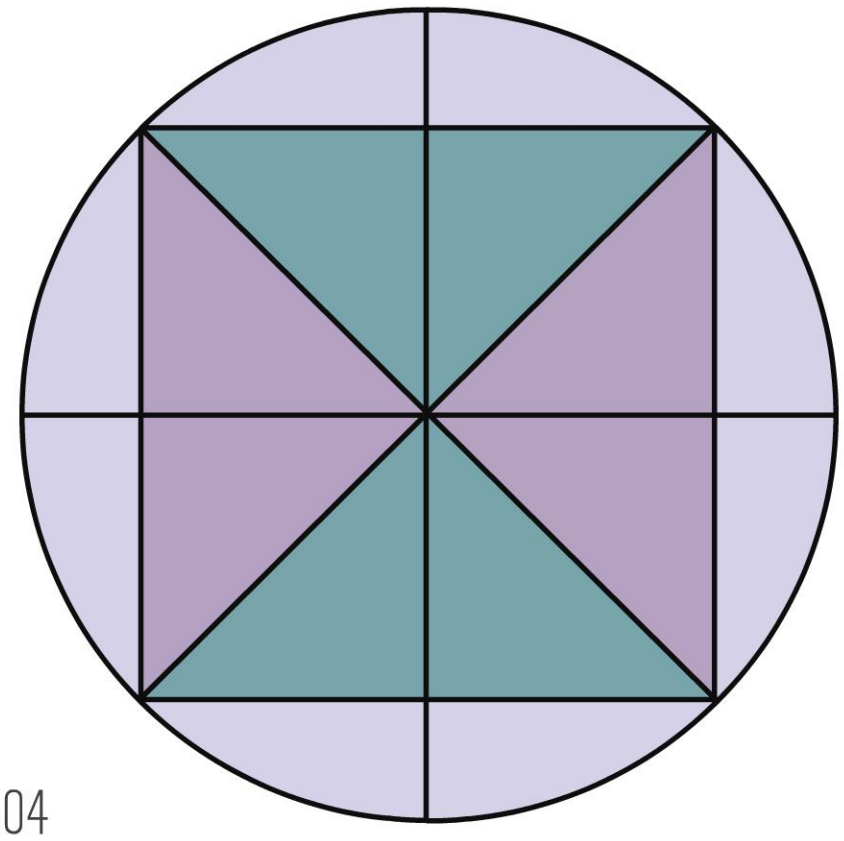

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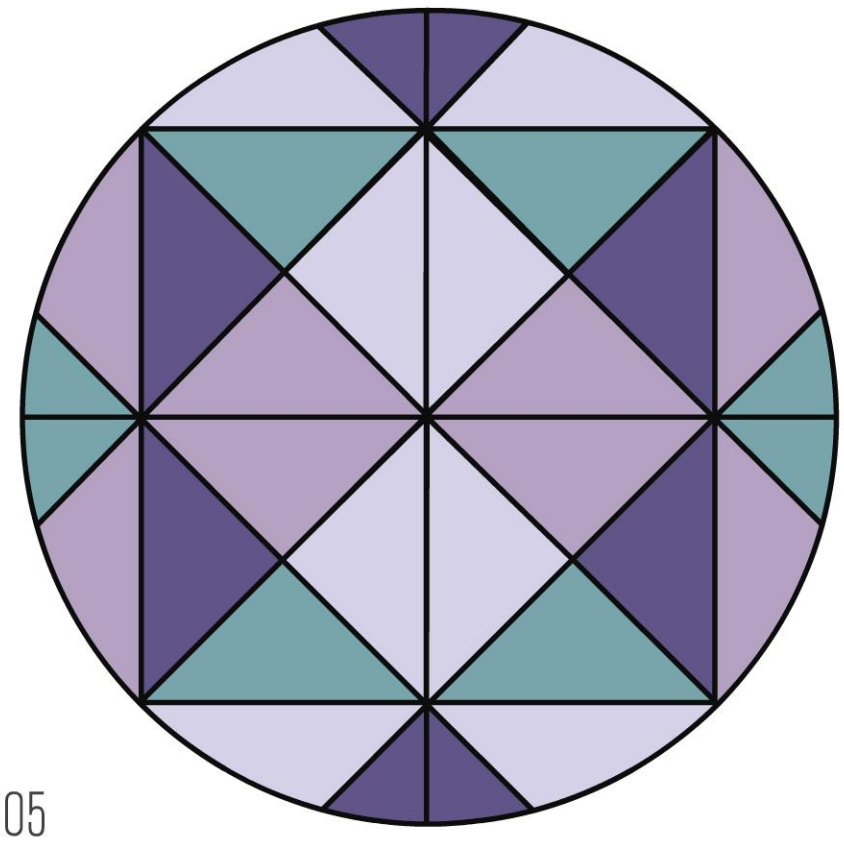

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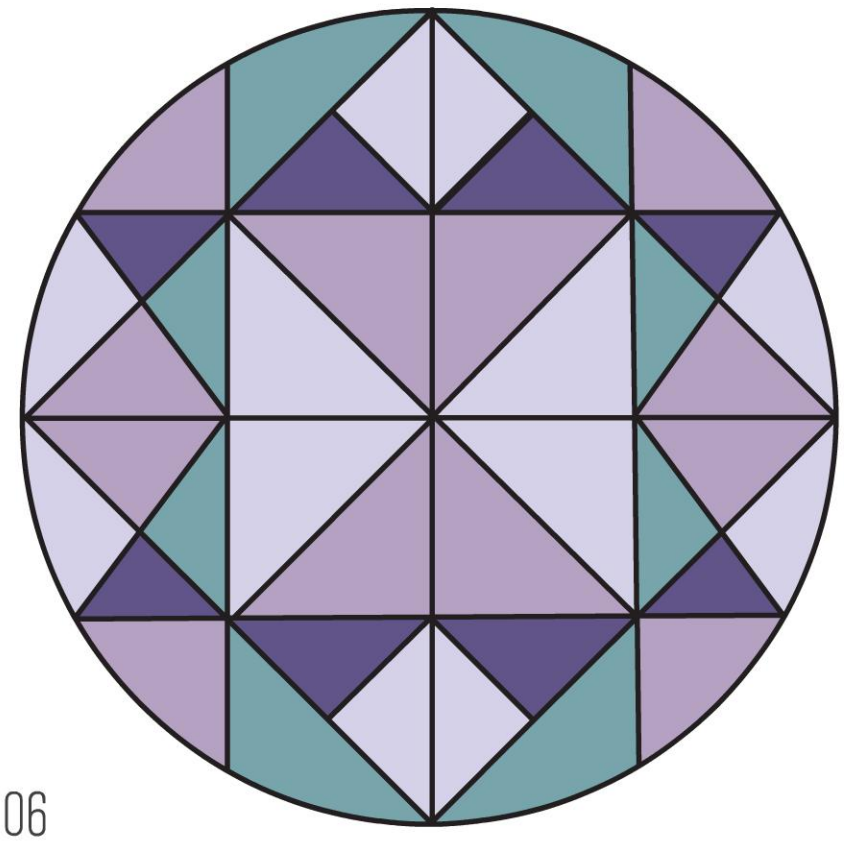

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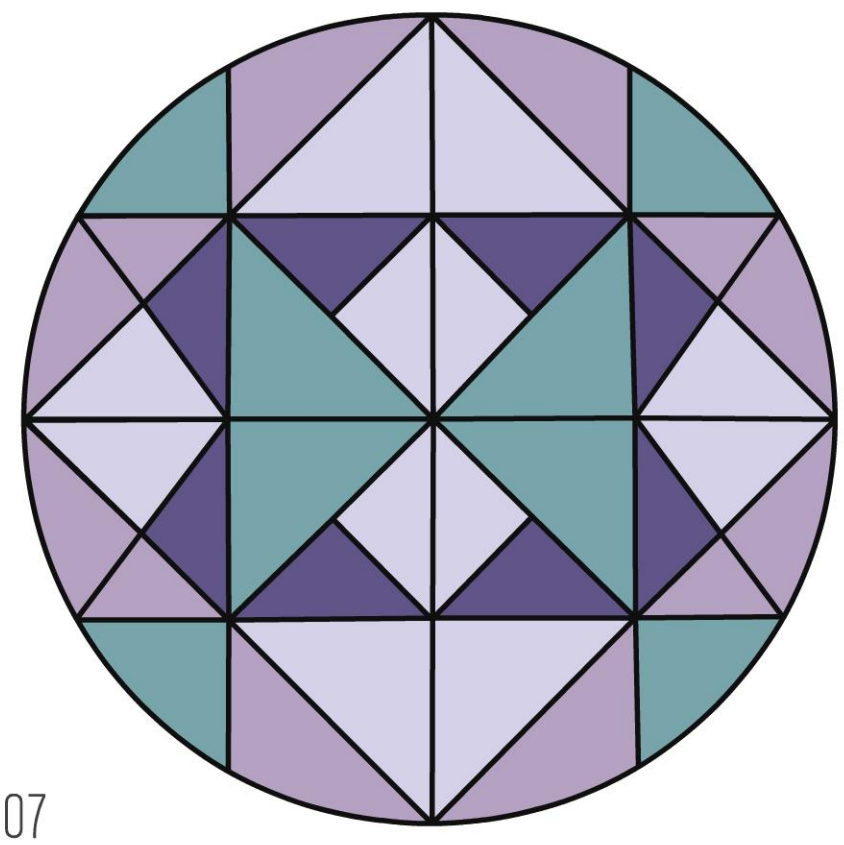

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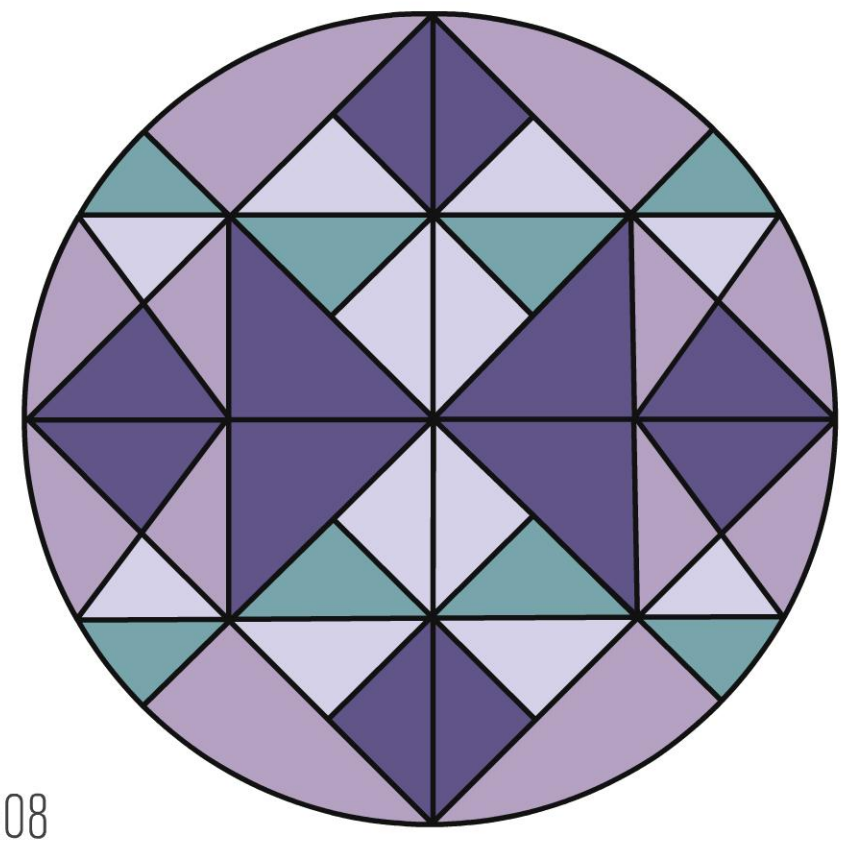

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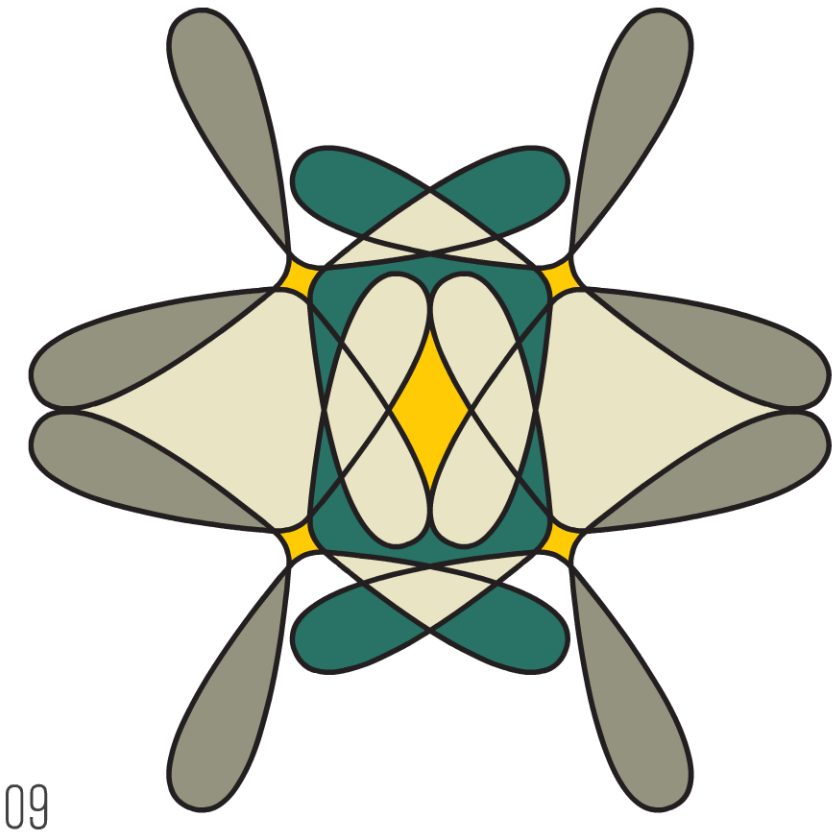
Clover Loop



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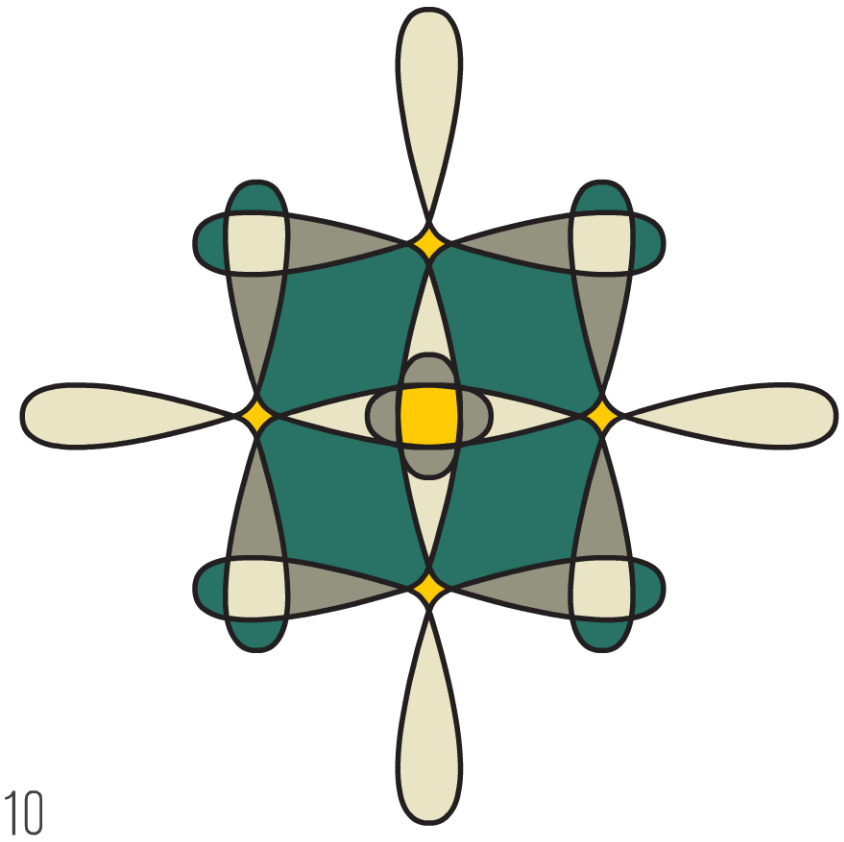

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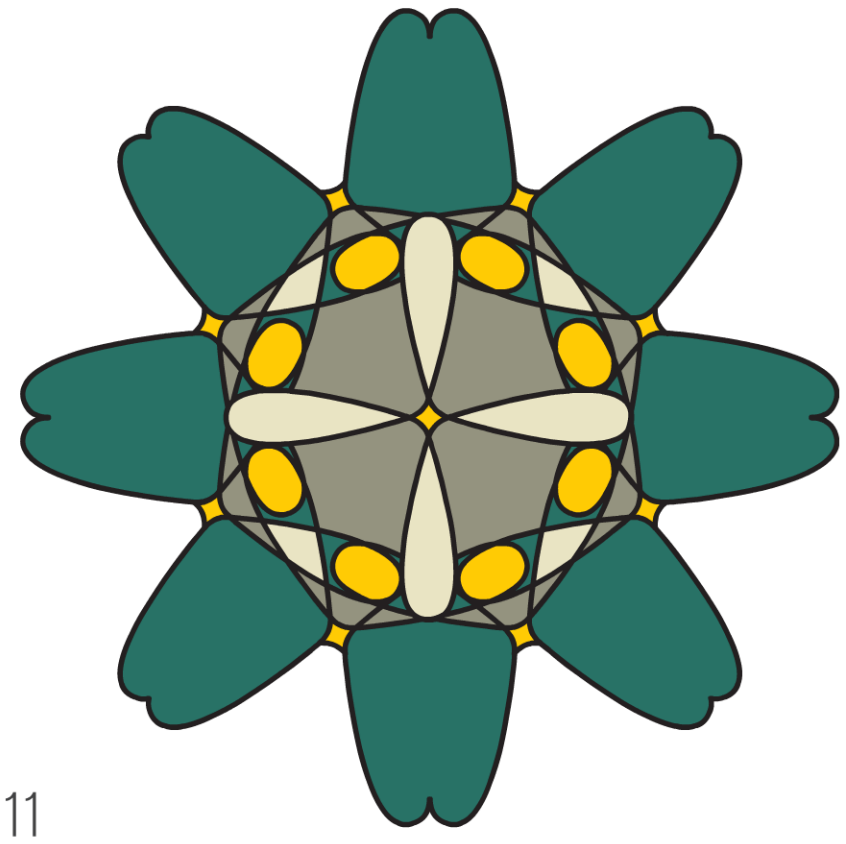

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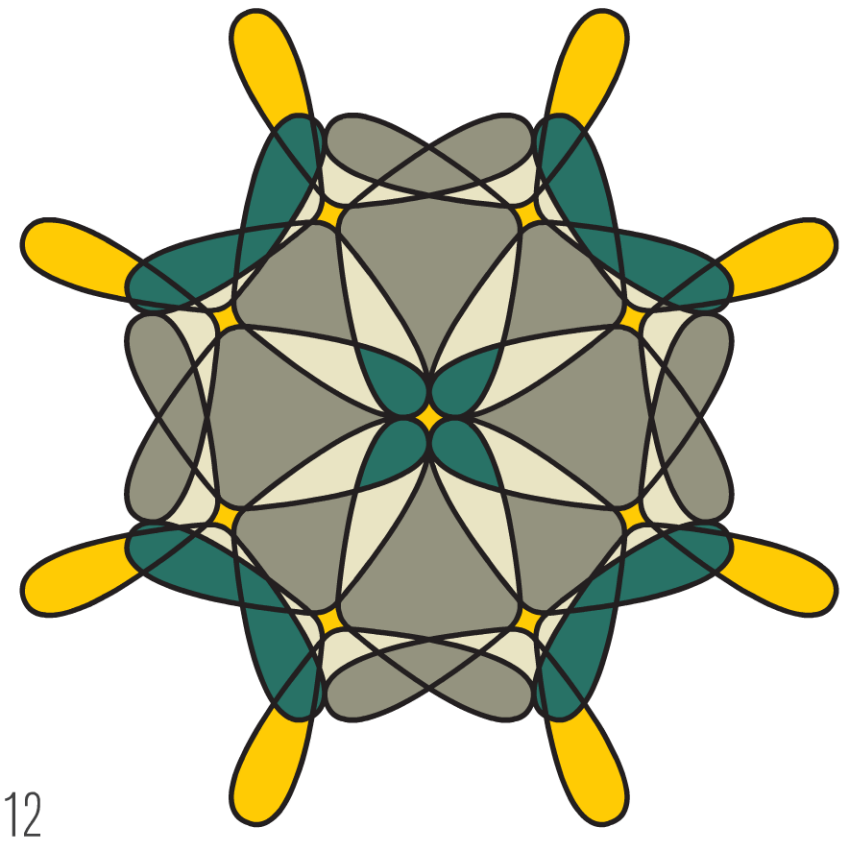

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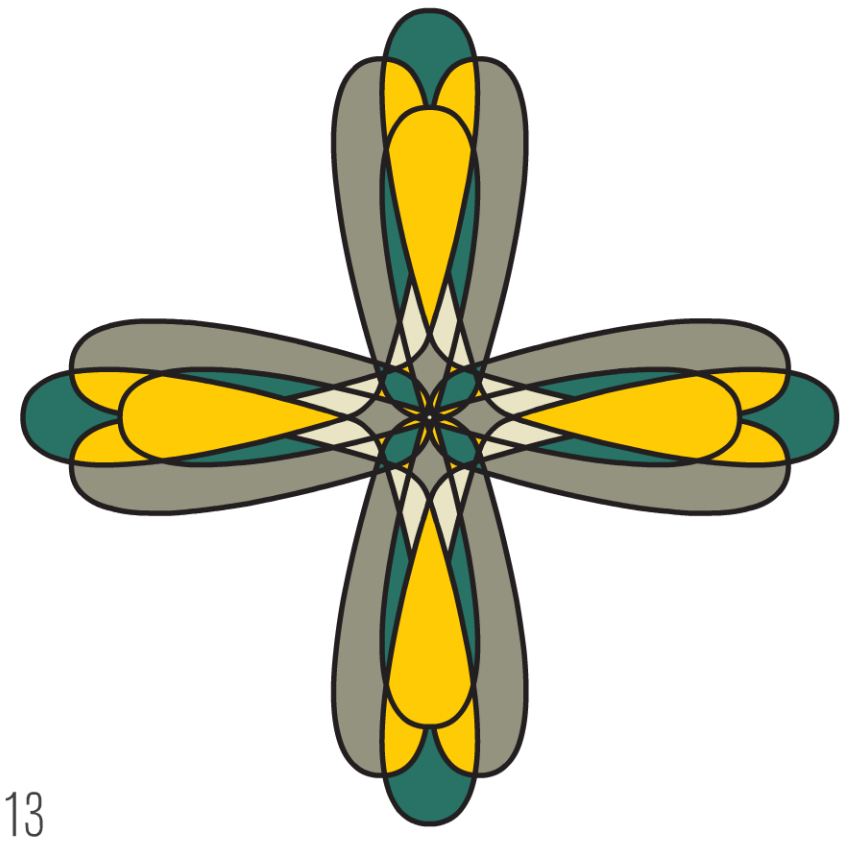

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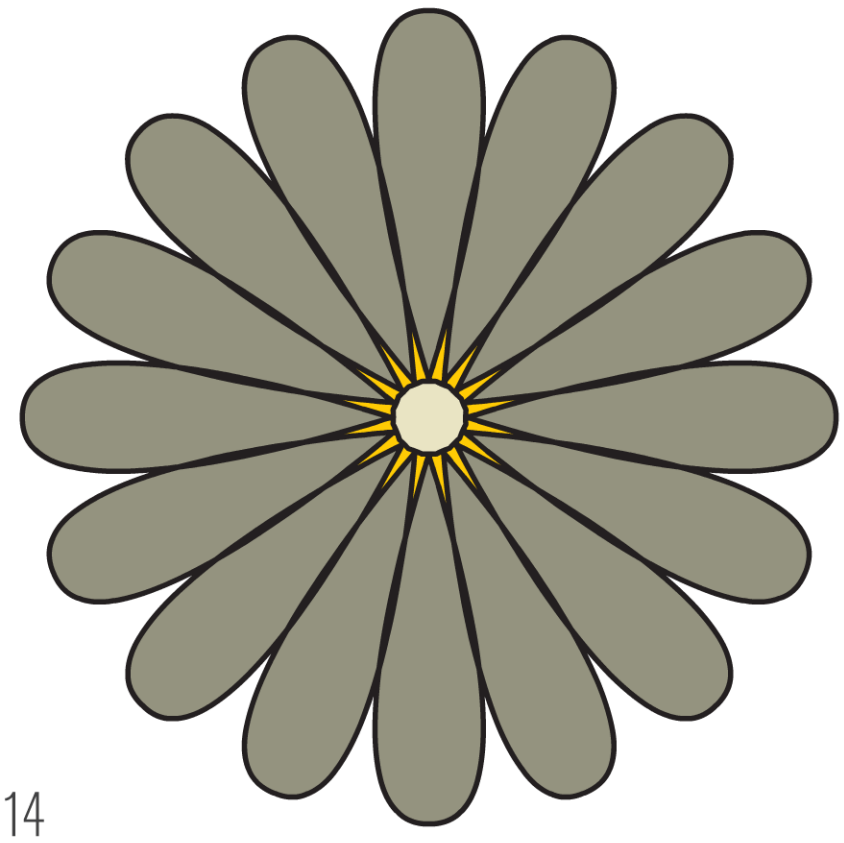

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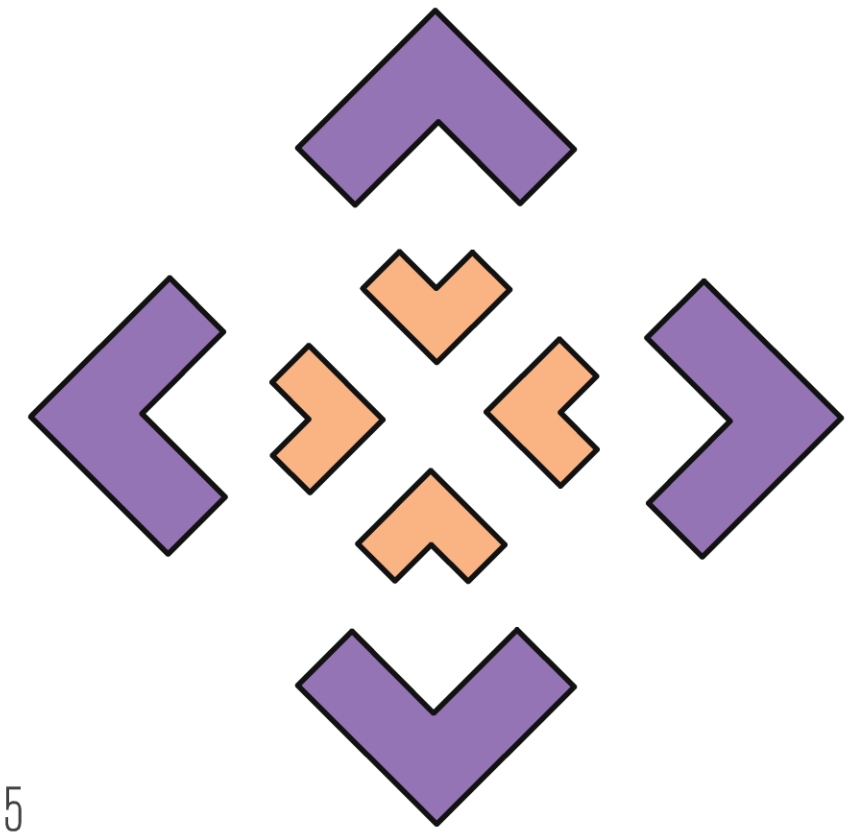
Corners



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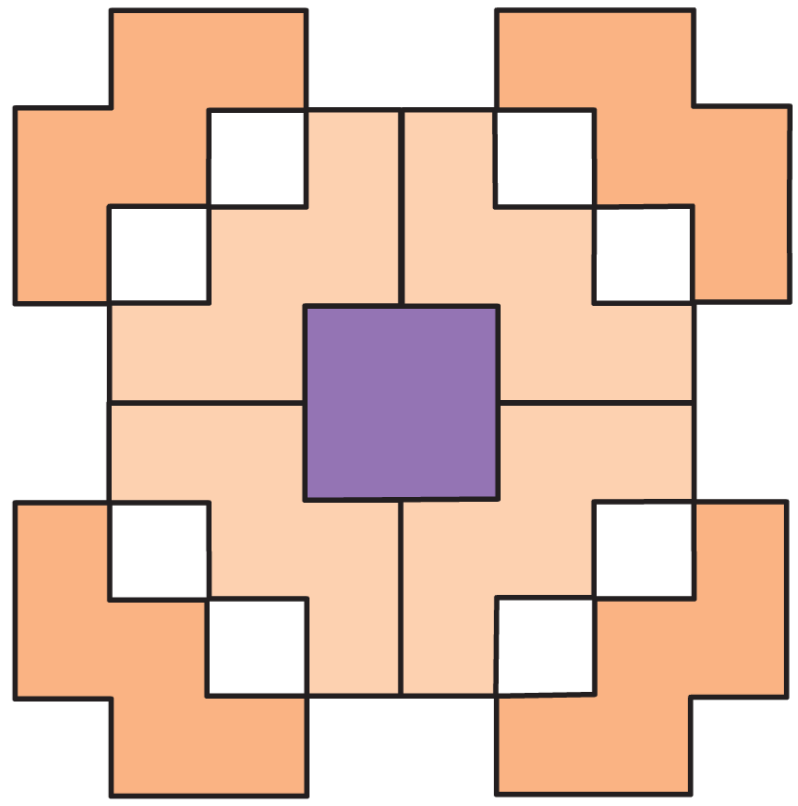

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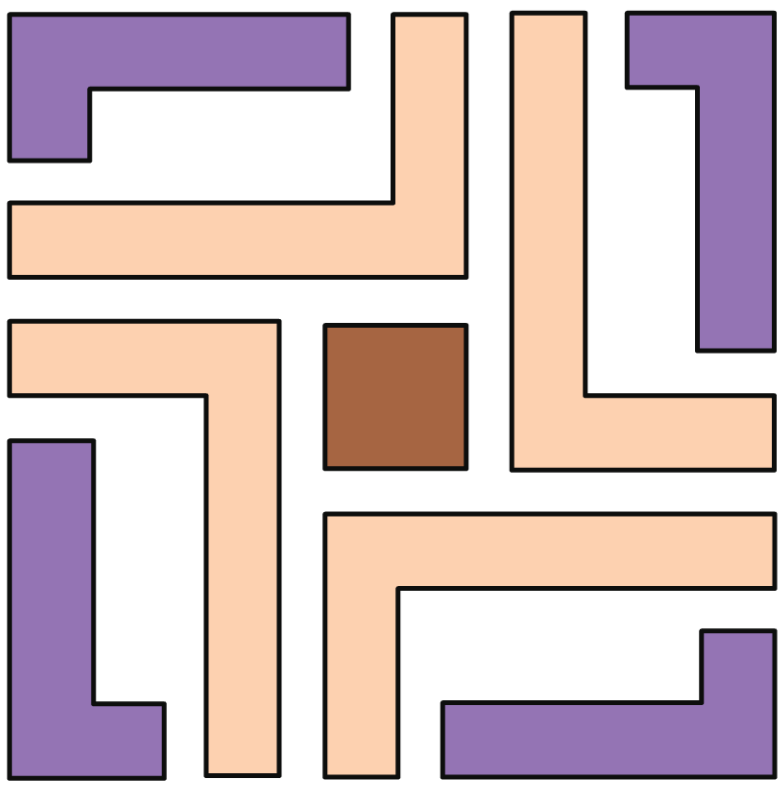

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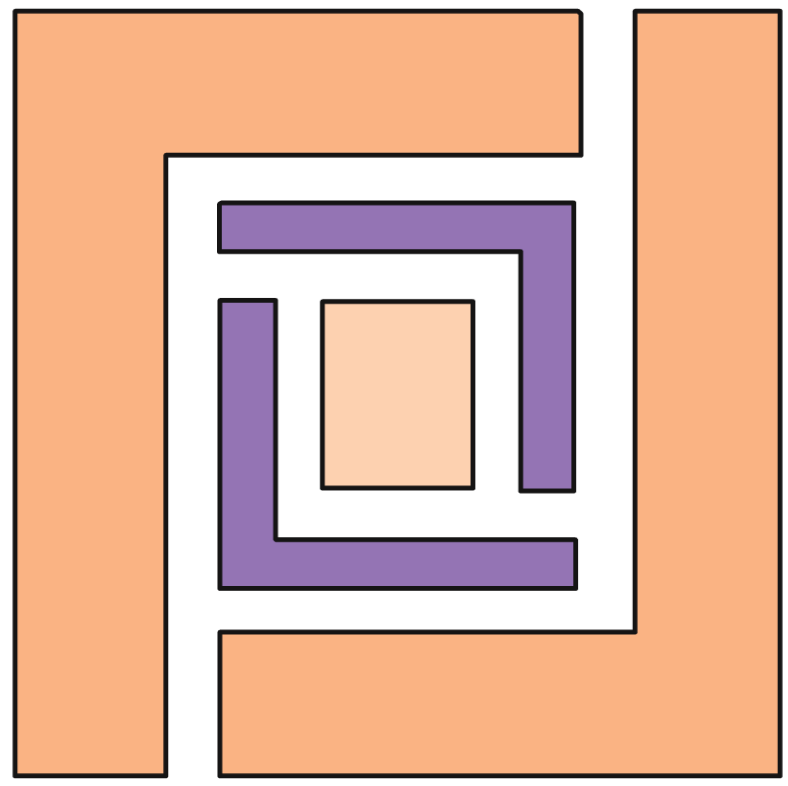

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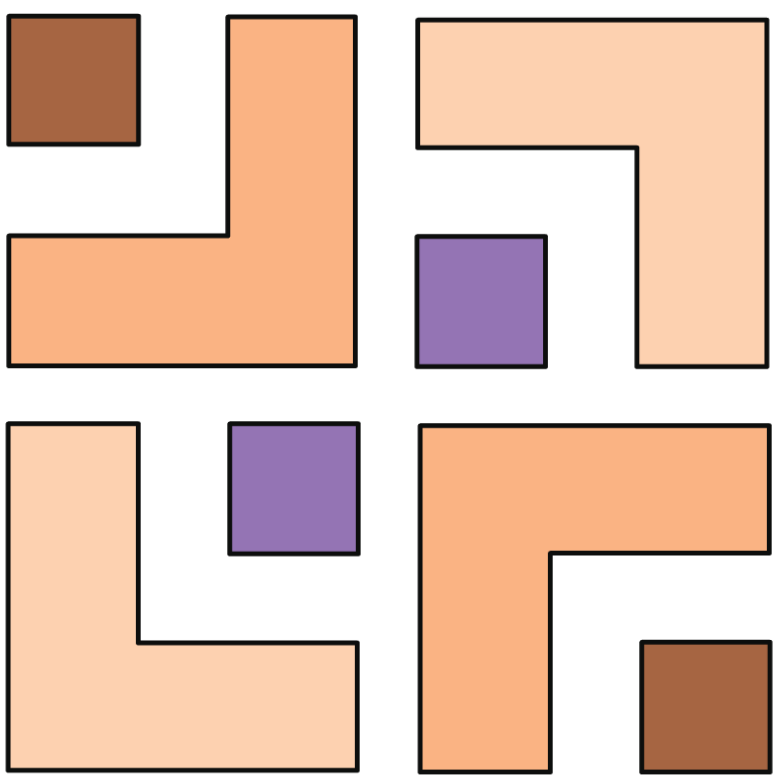

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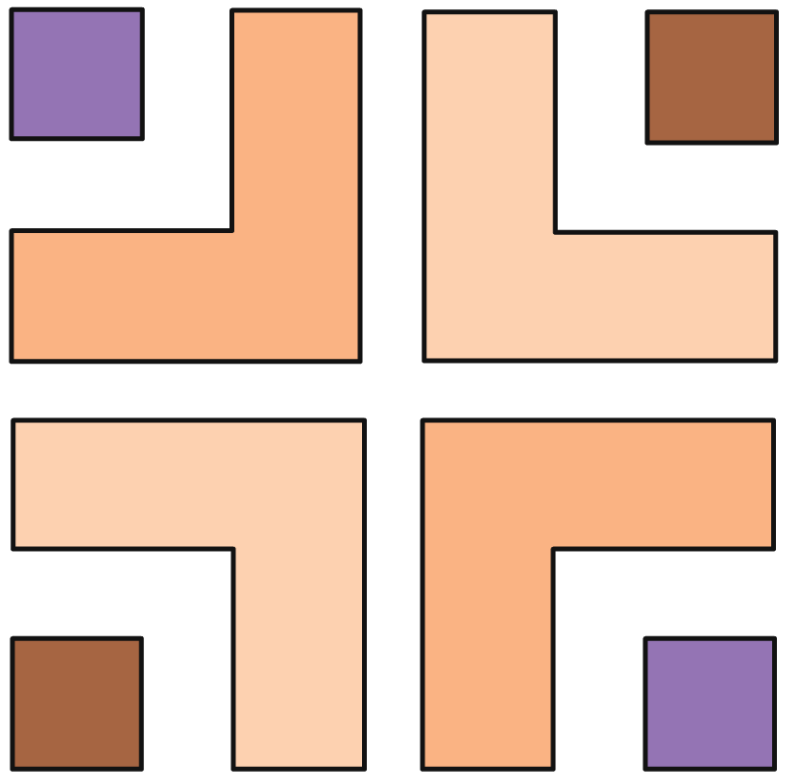

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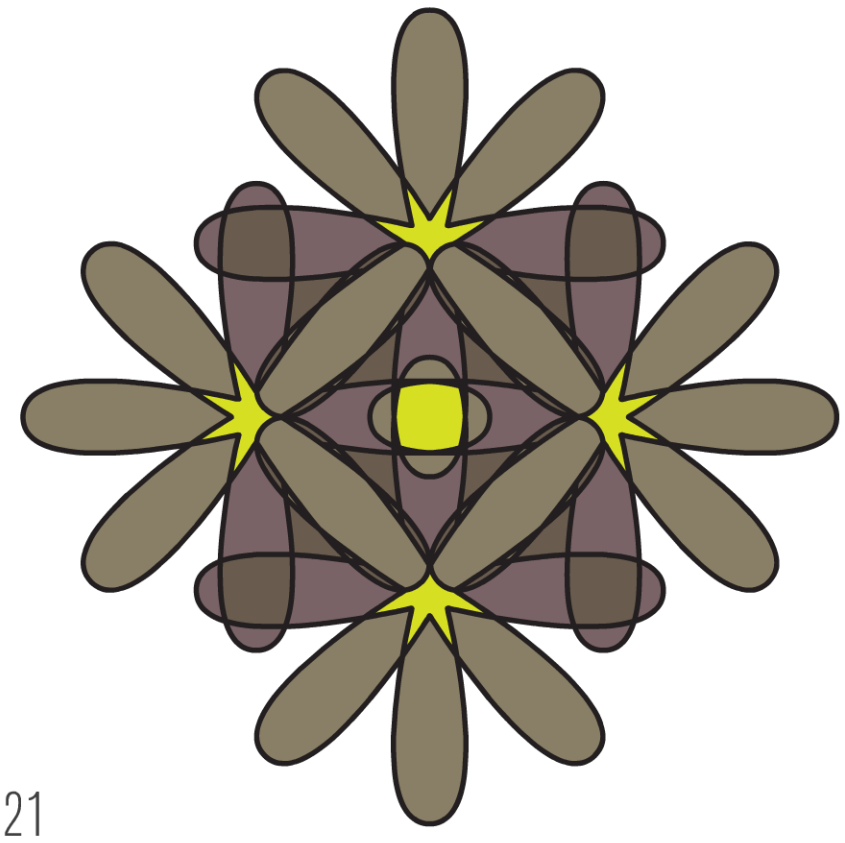
Criss-Cross Curves



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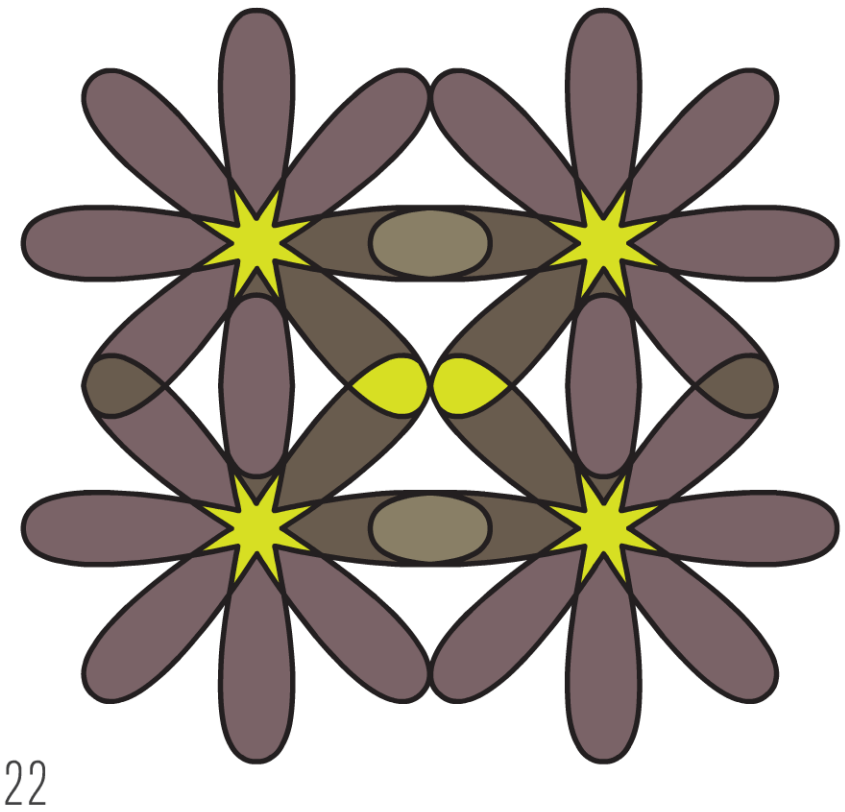

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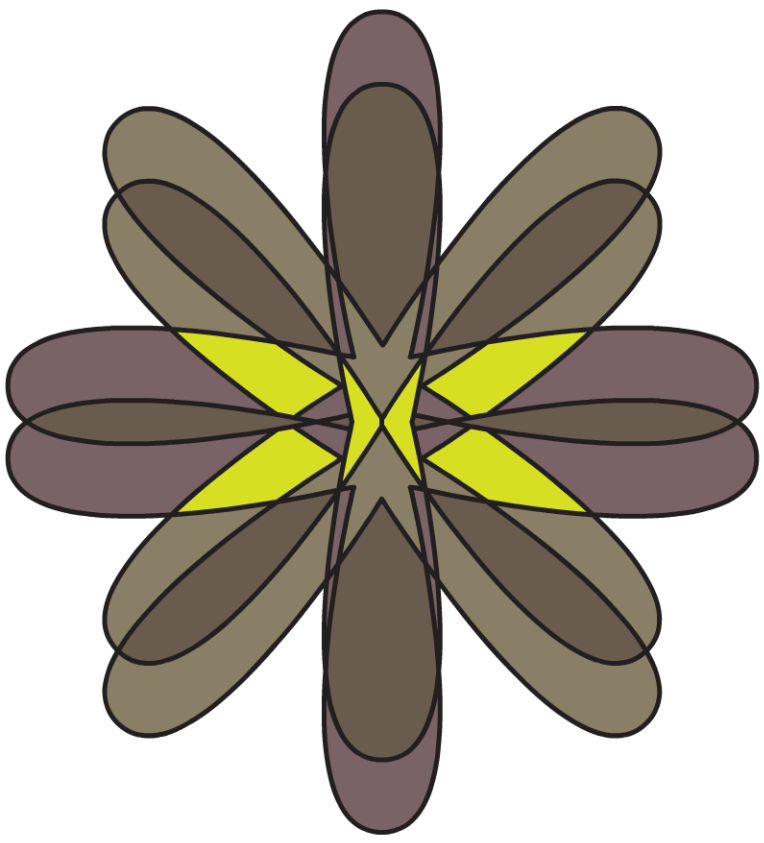

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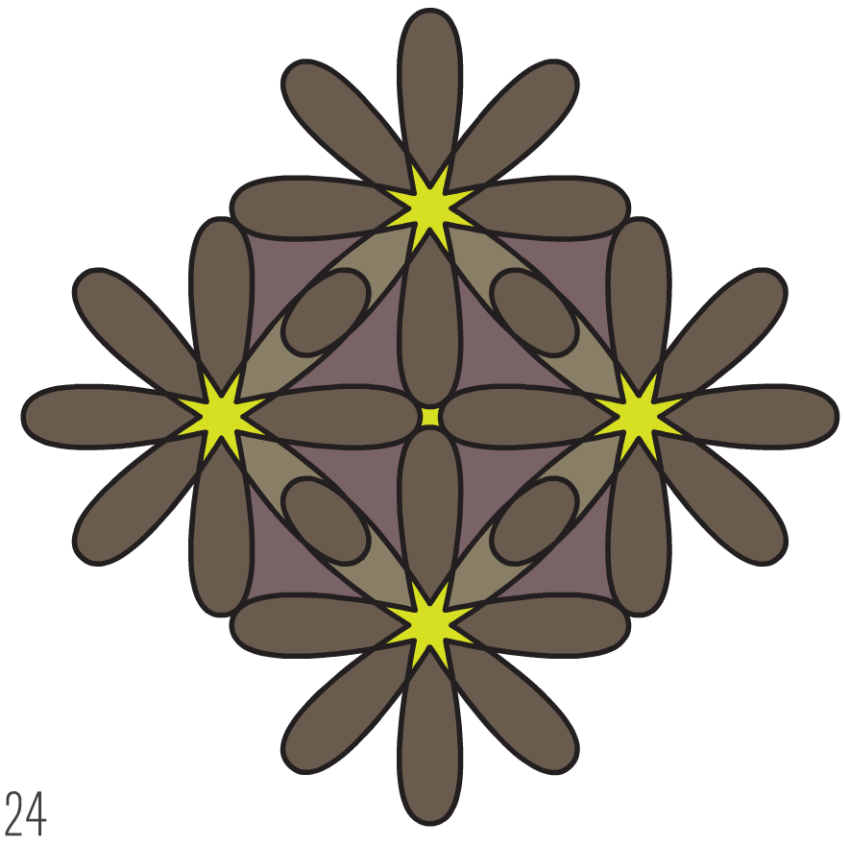

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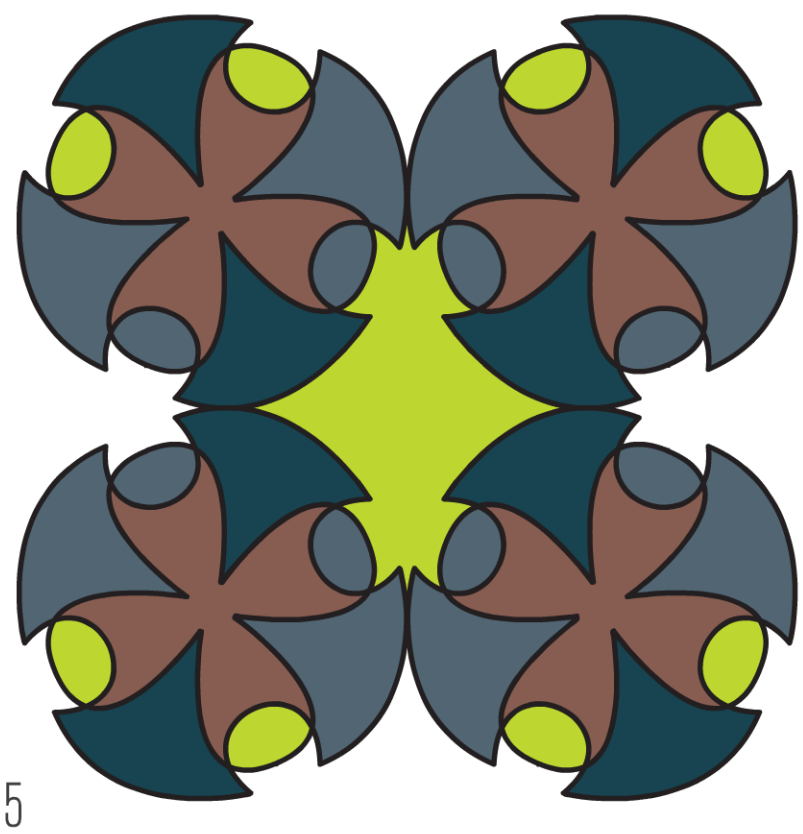

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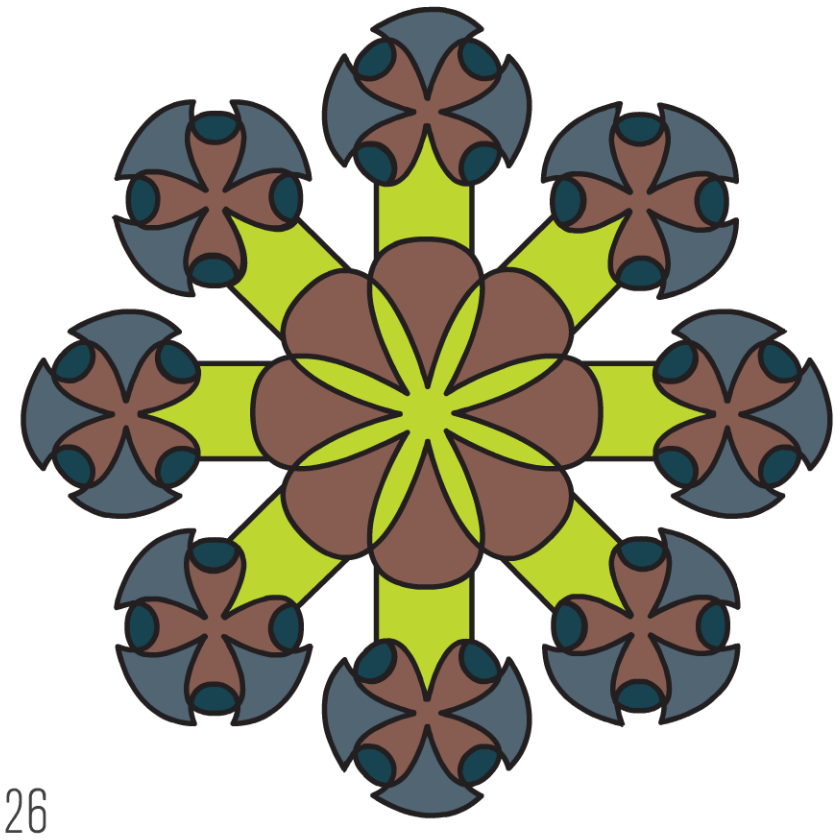

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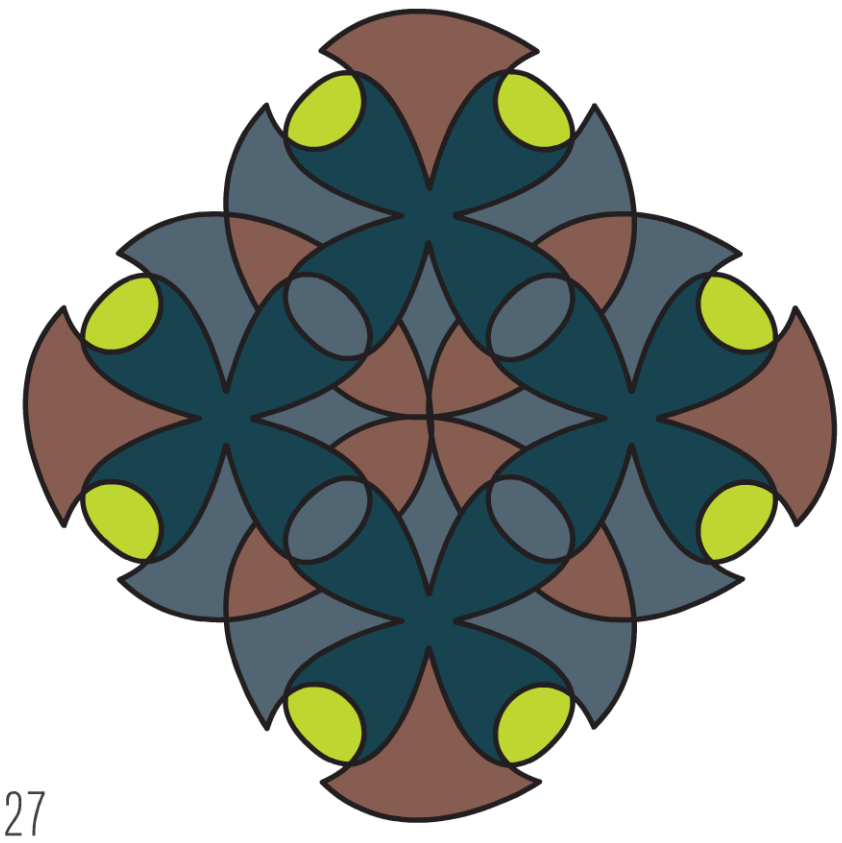

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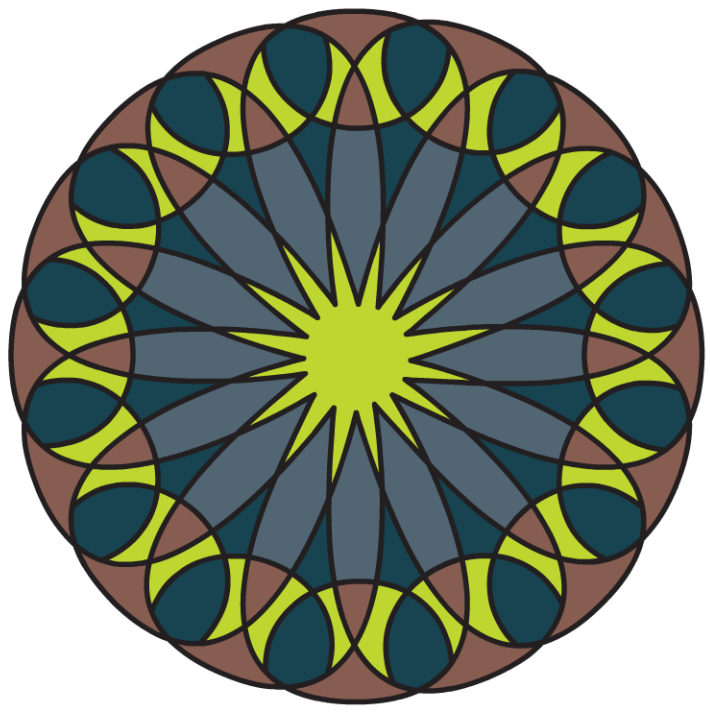

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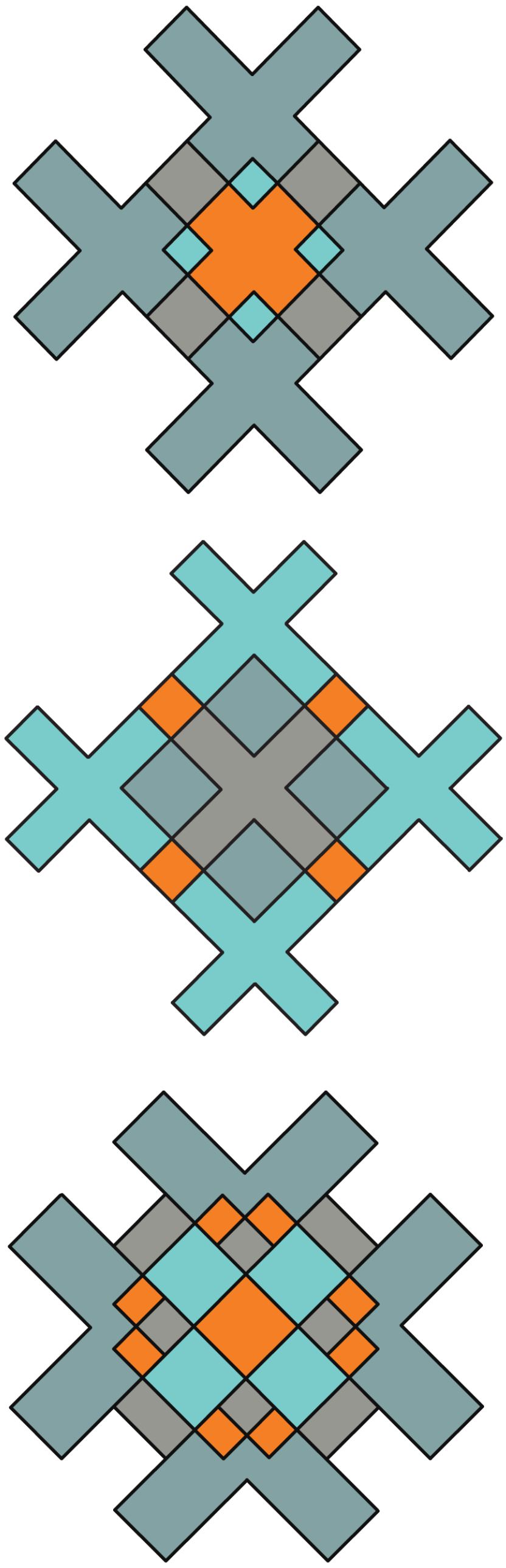
Crosses



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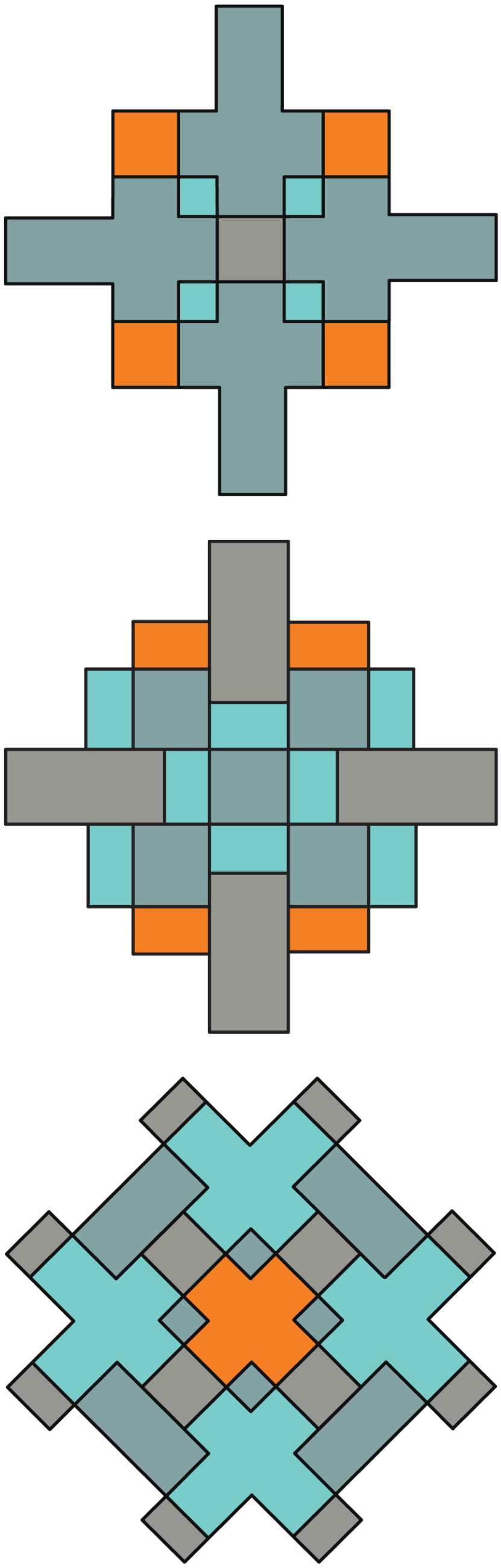

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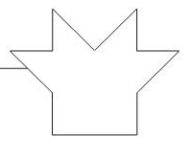
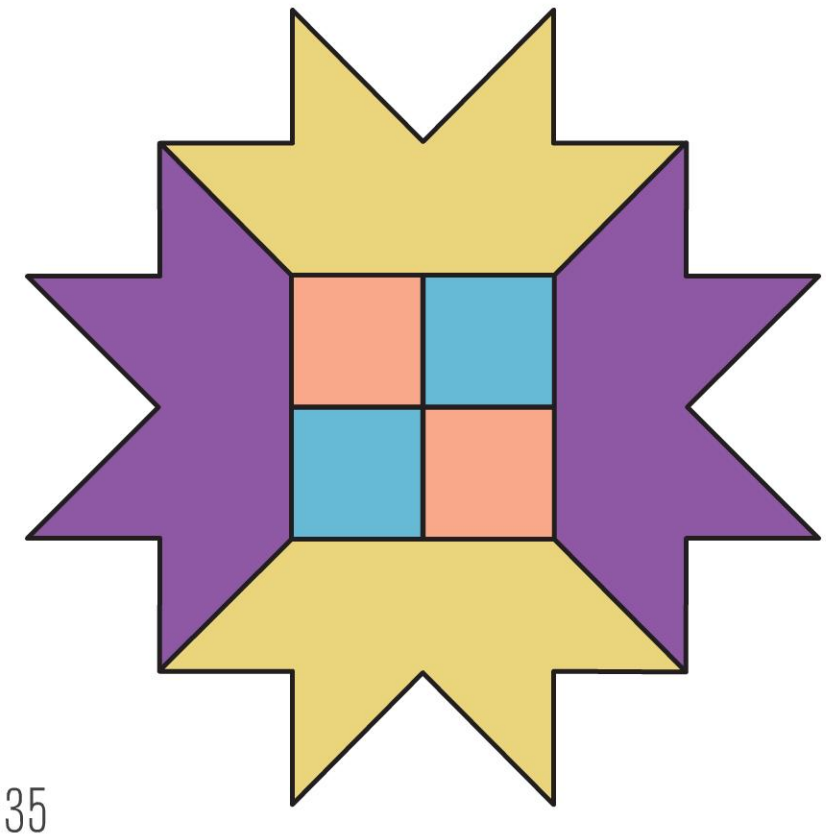


Crowns



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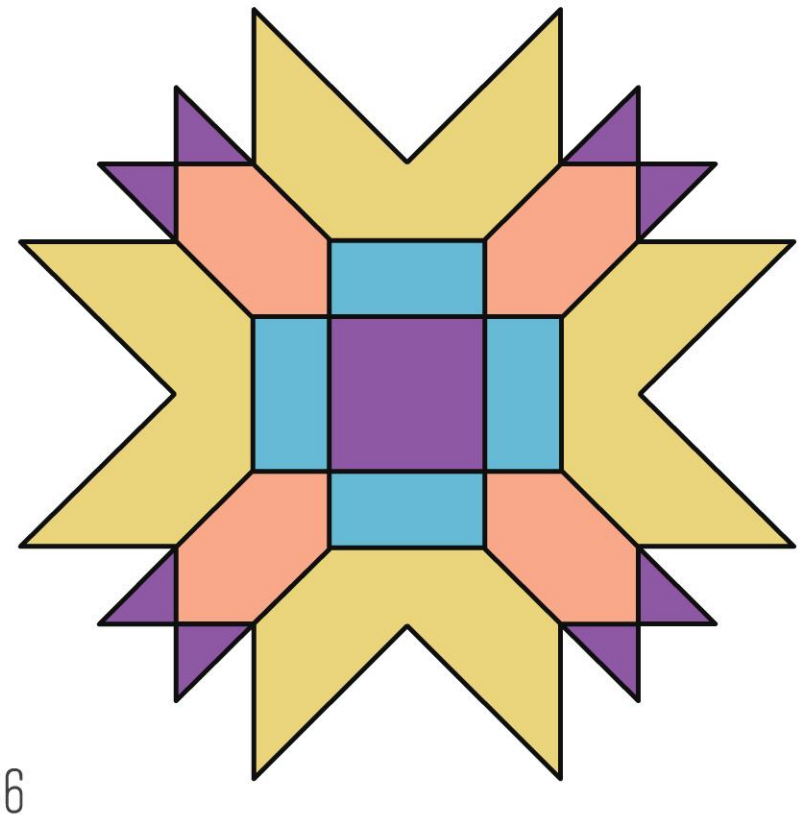

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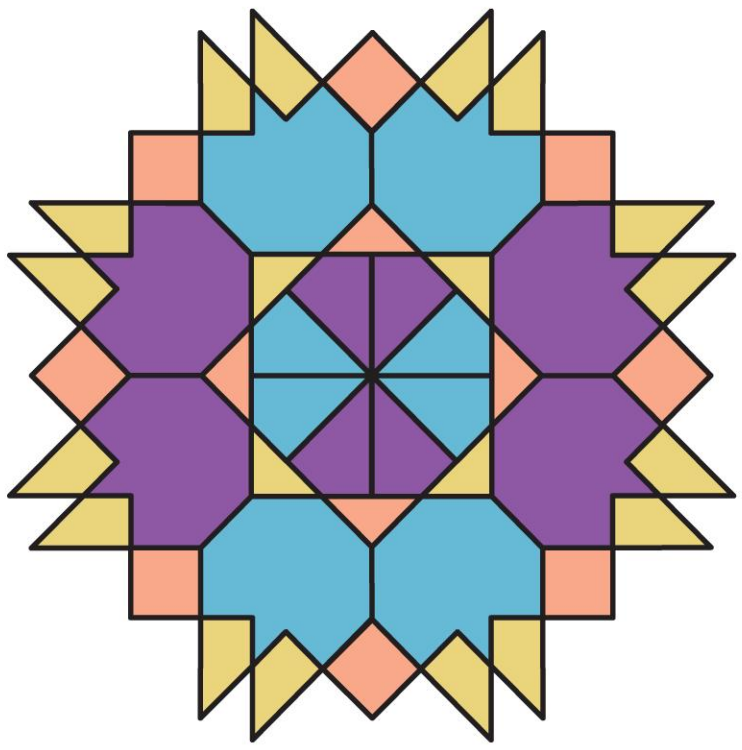

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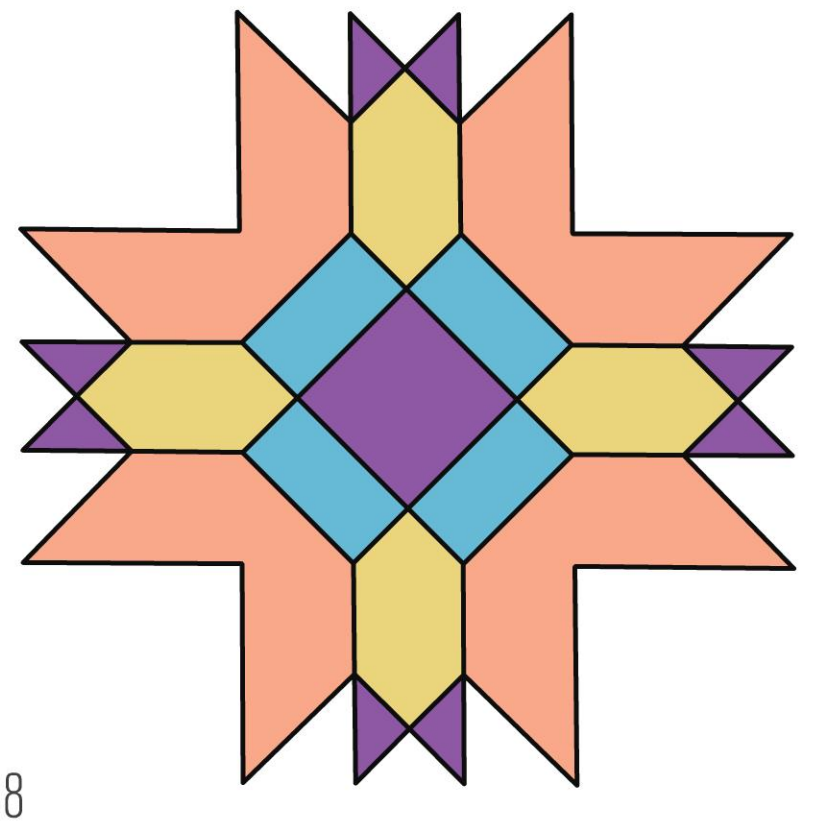

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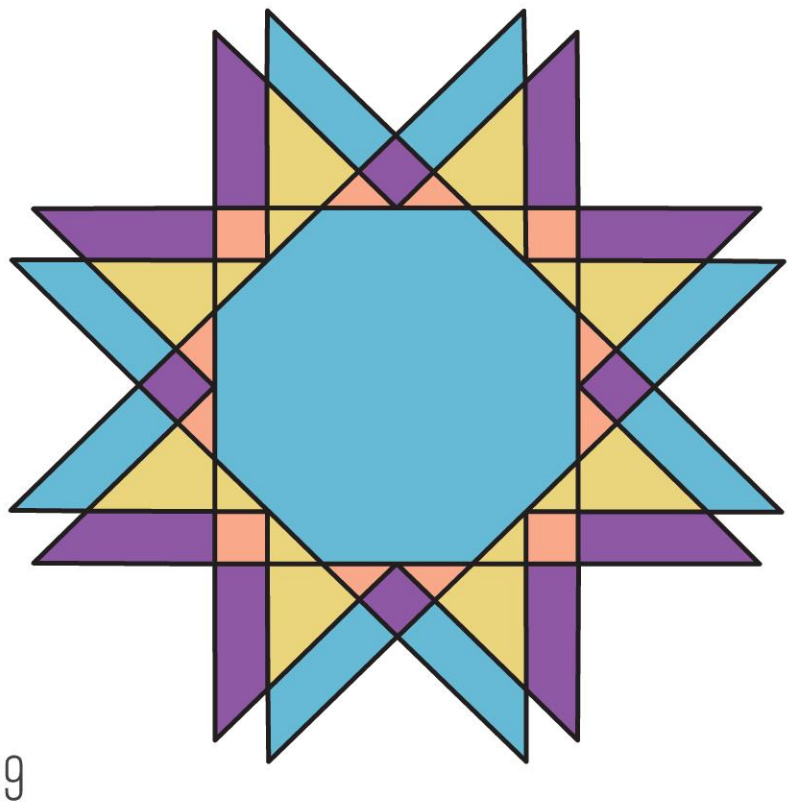

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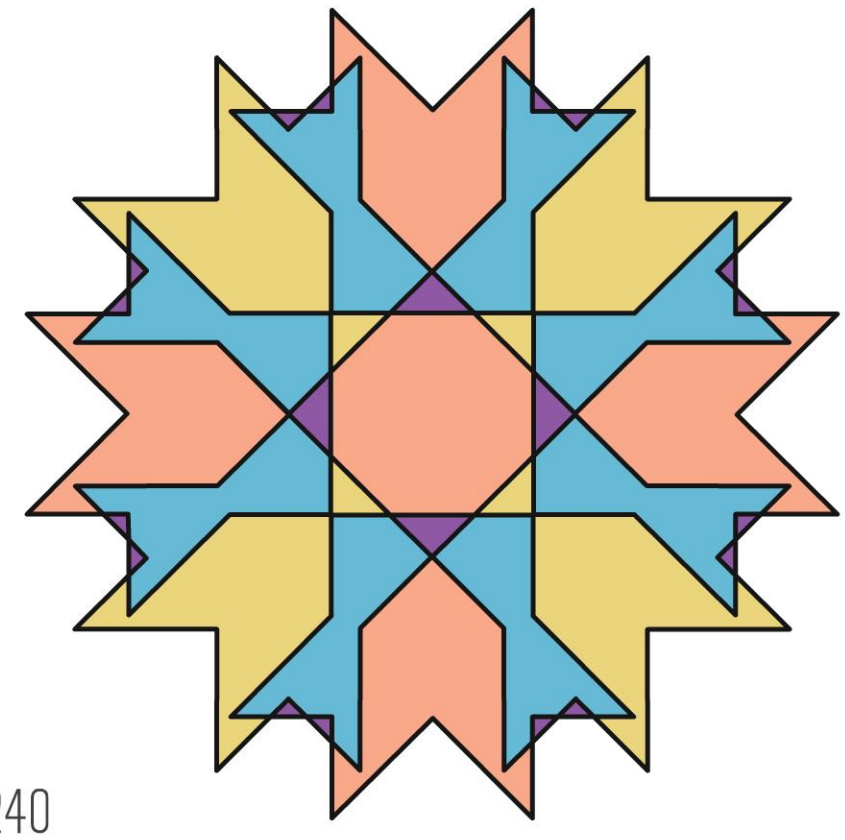

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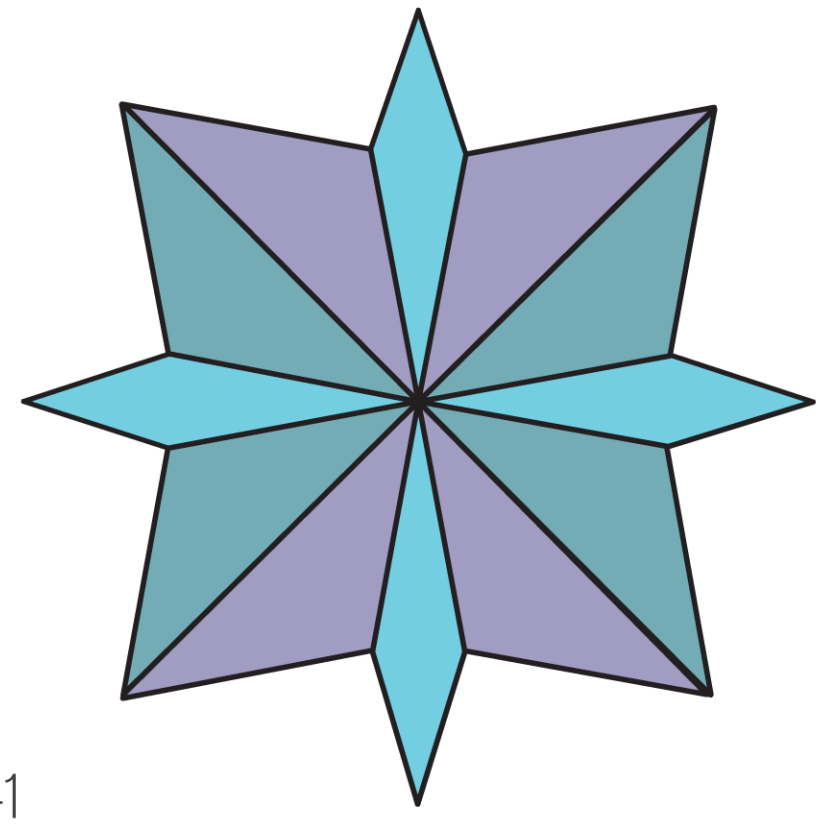
Diamonds



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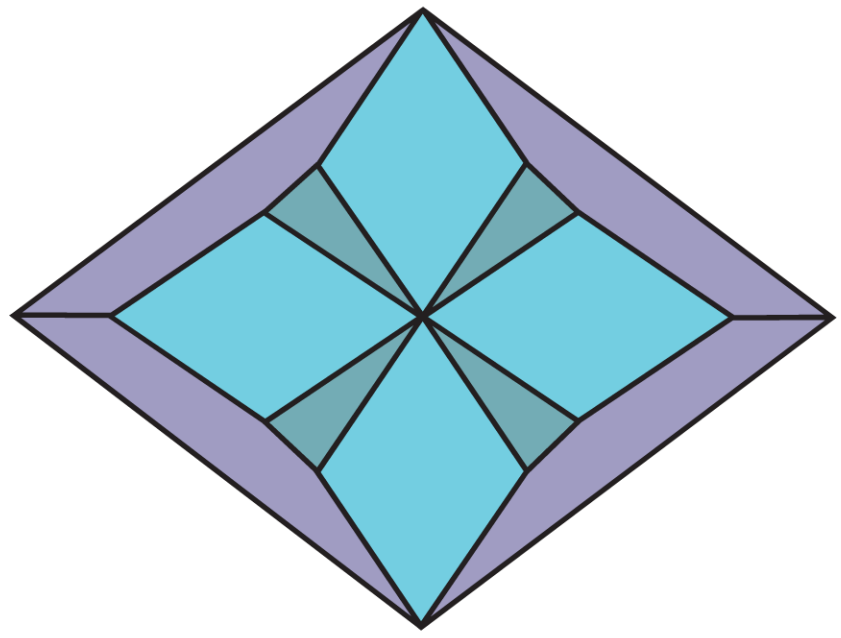

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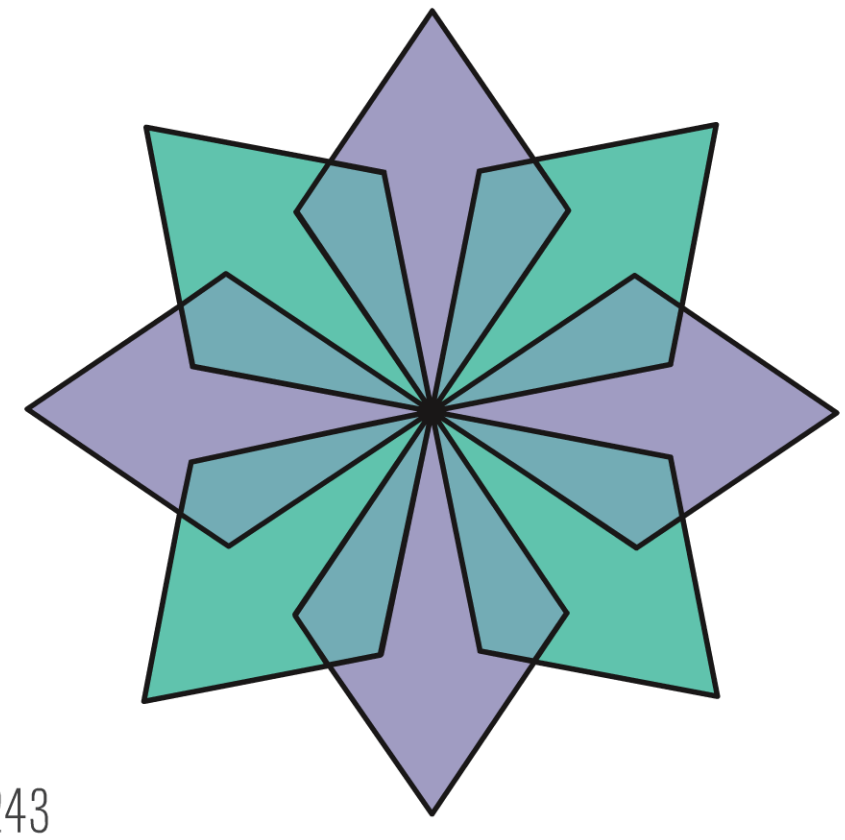

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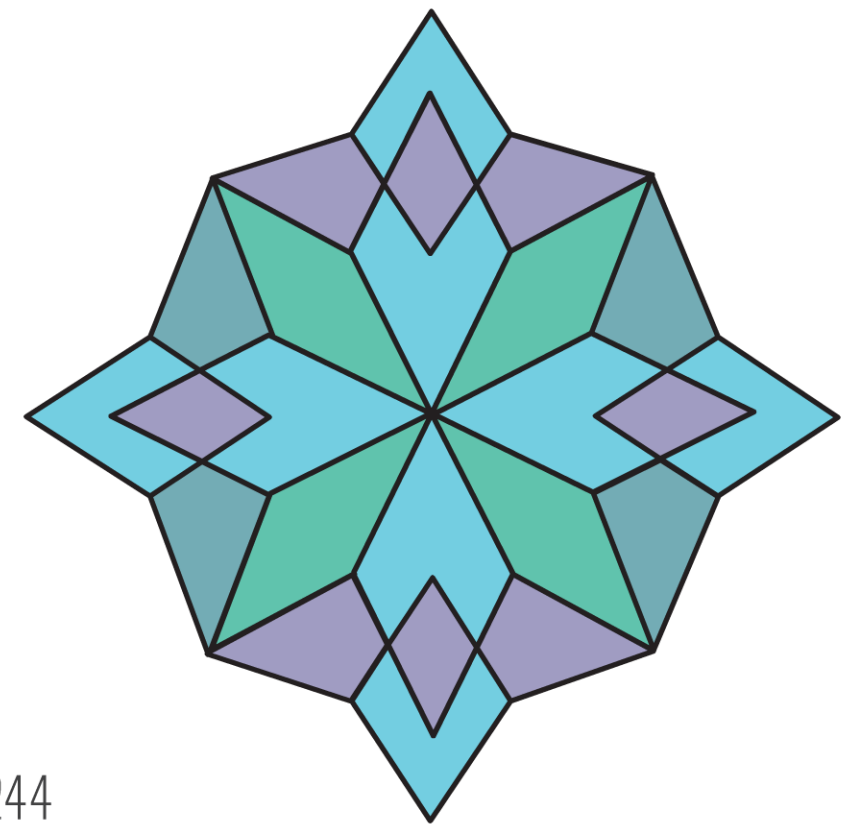

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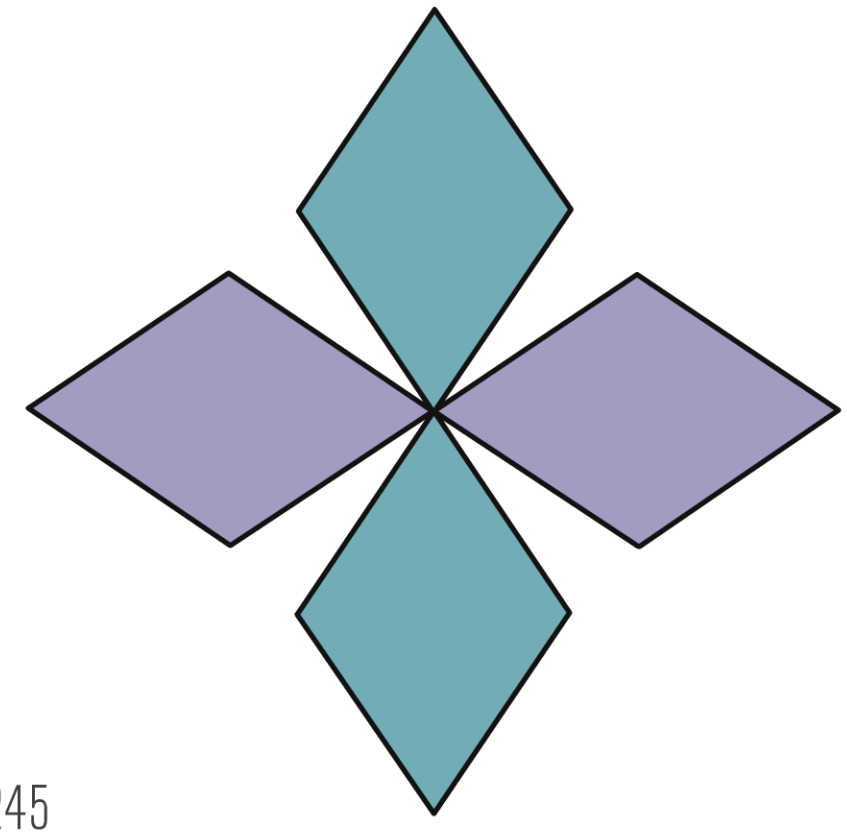

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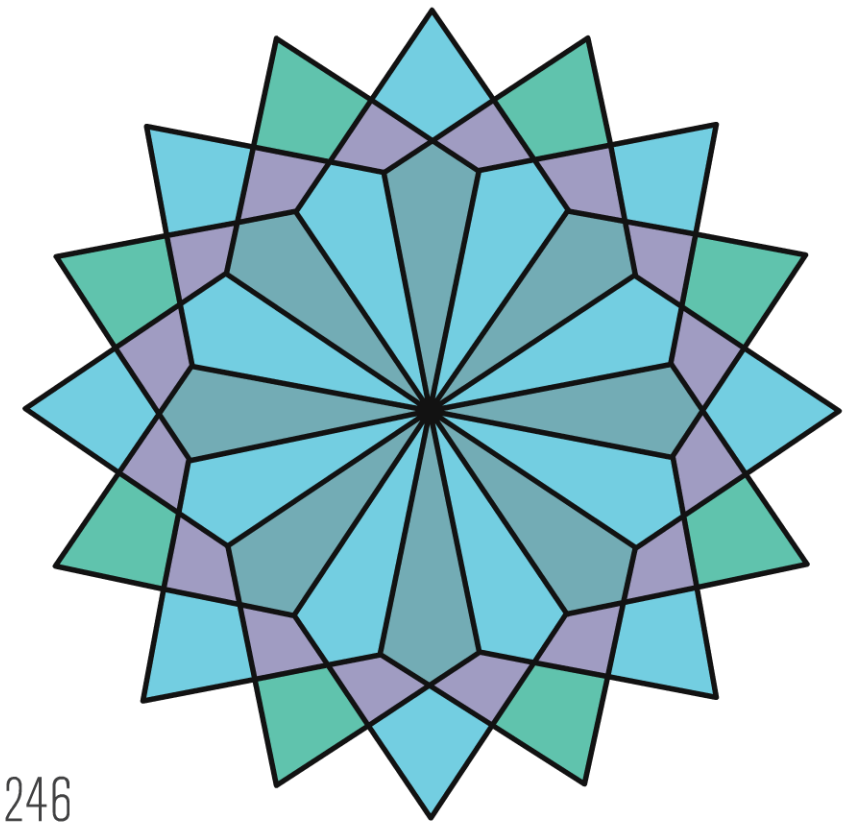

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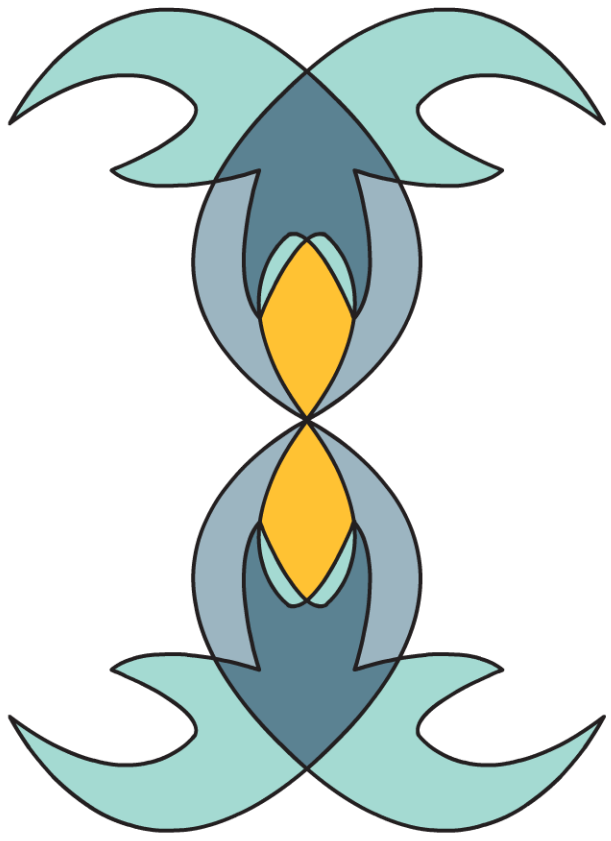
Double Horn



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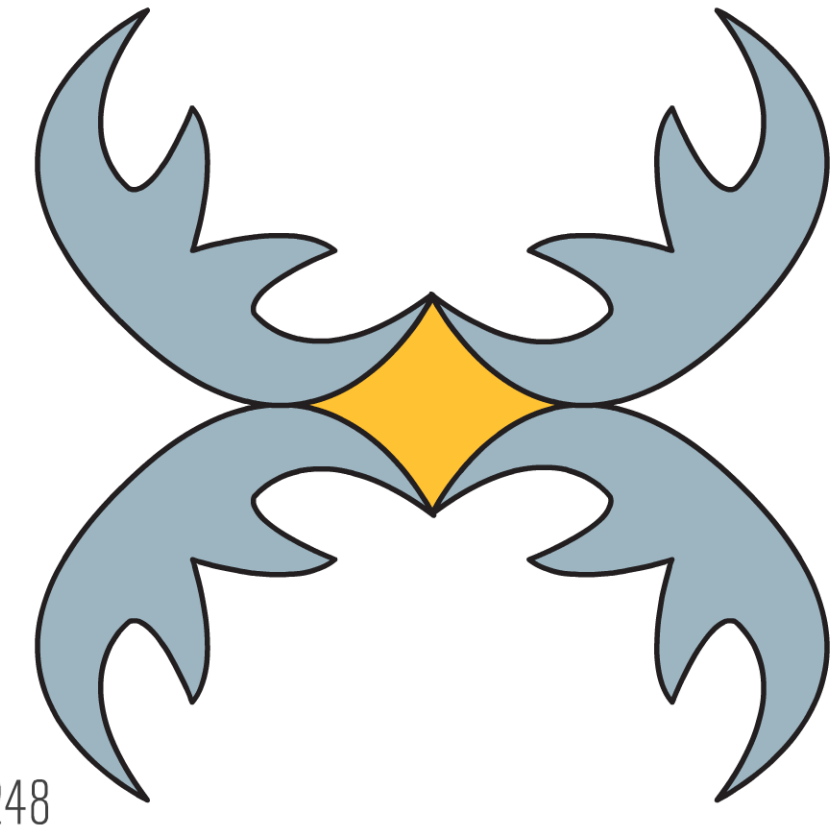

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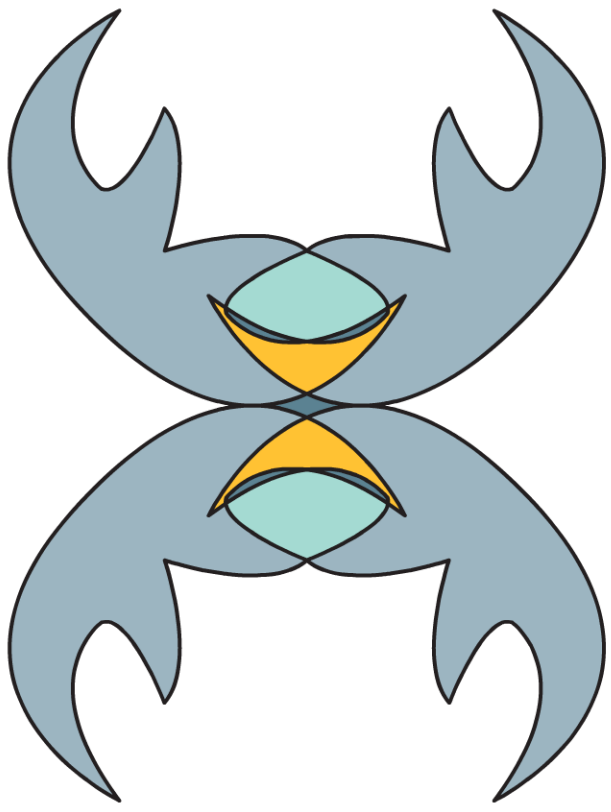

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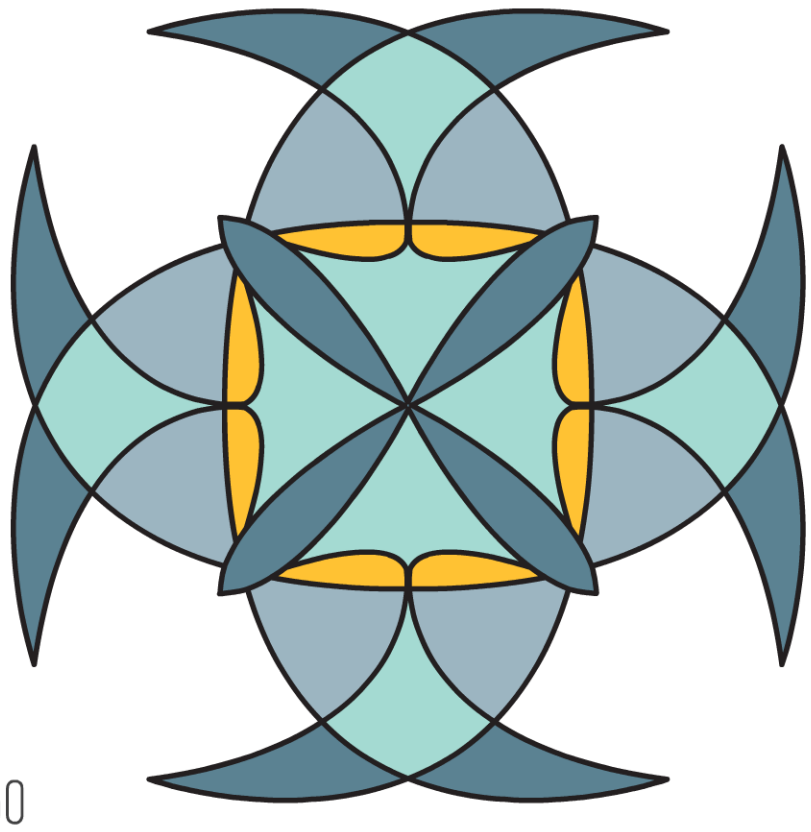

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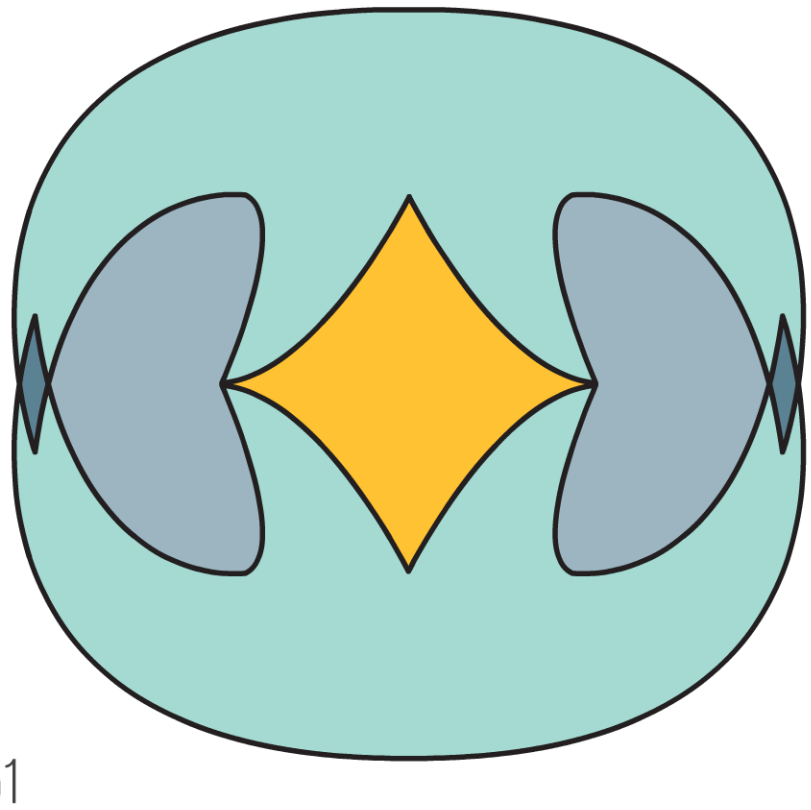

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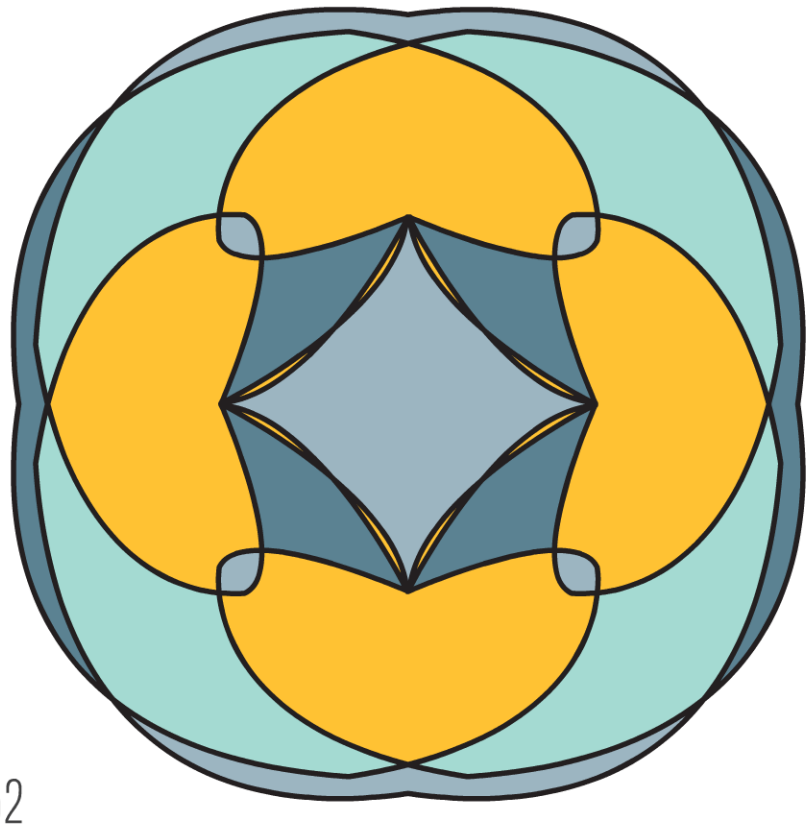

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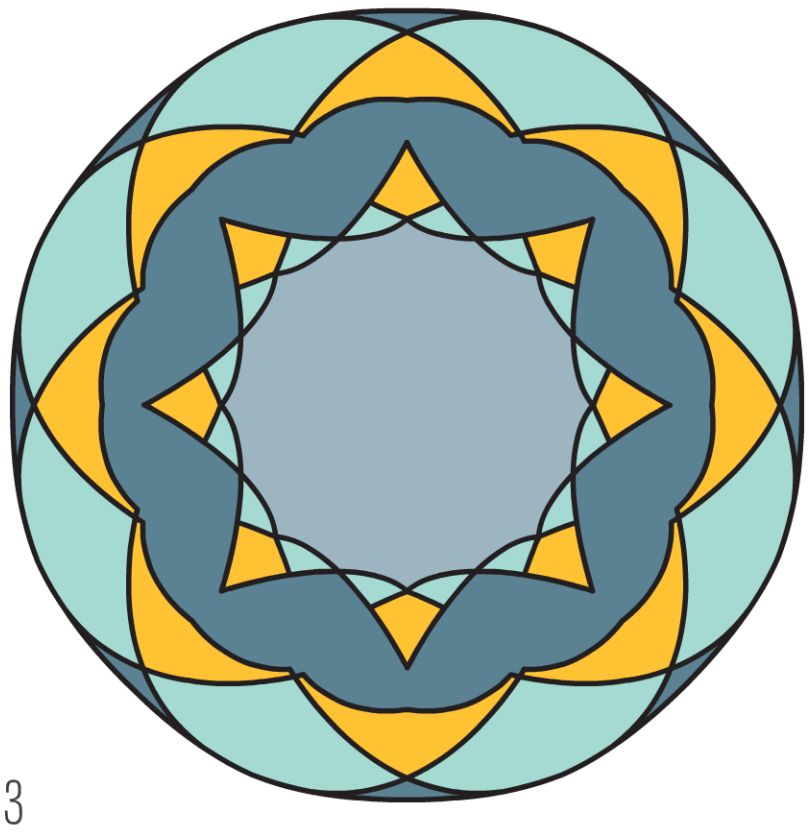

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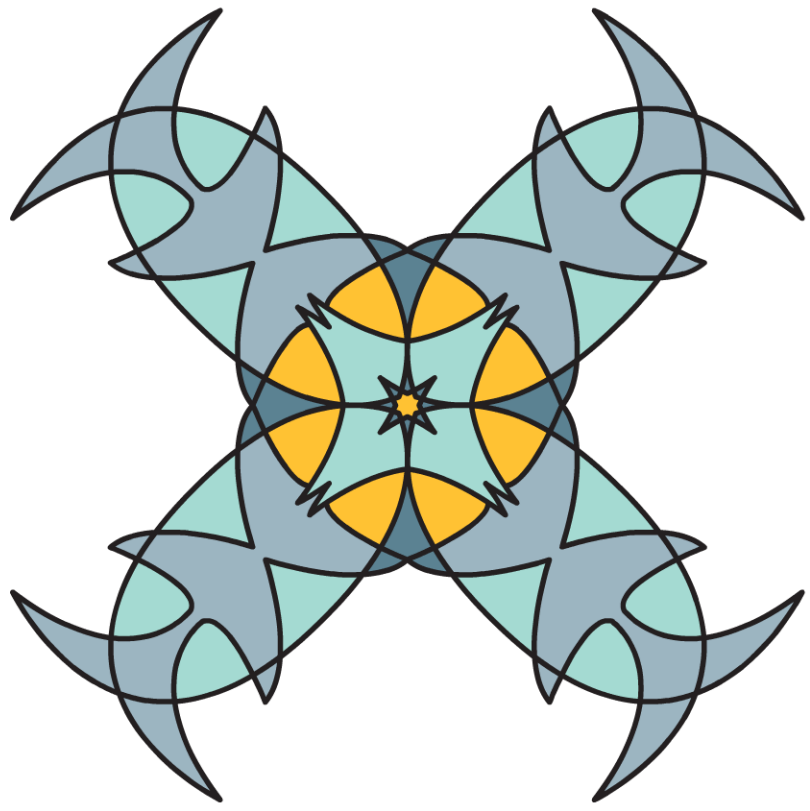

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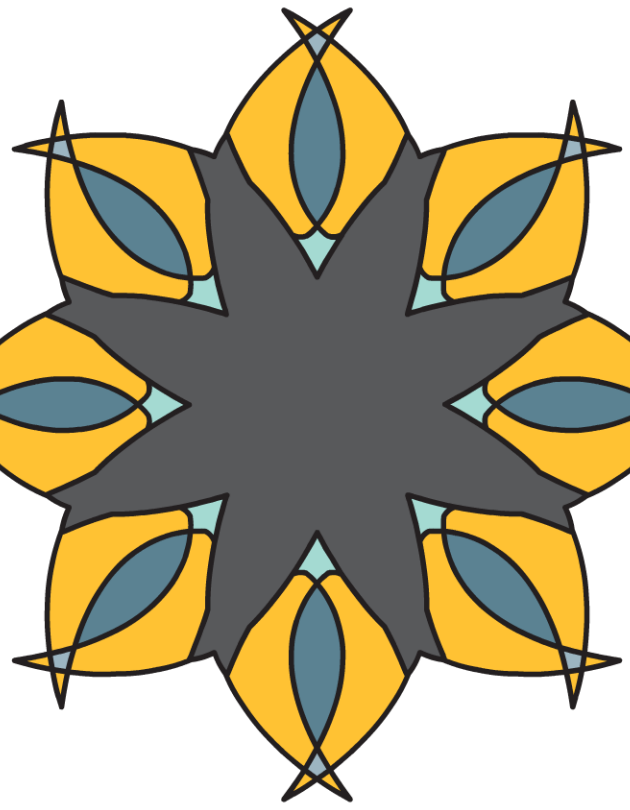

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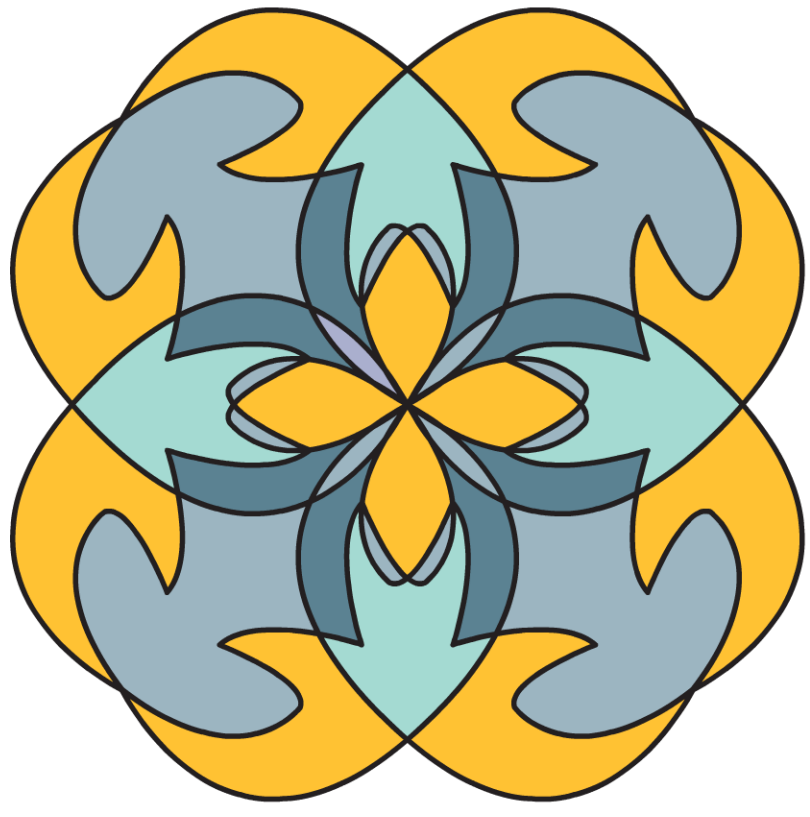

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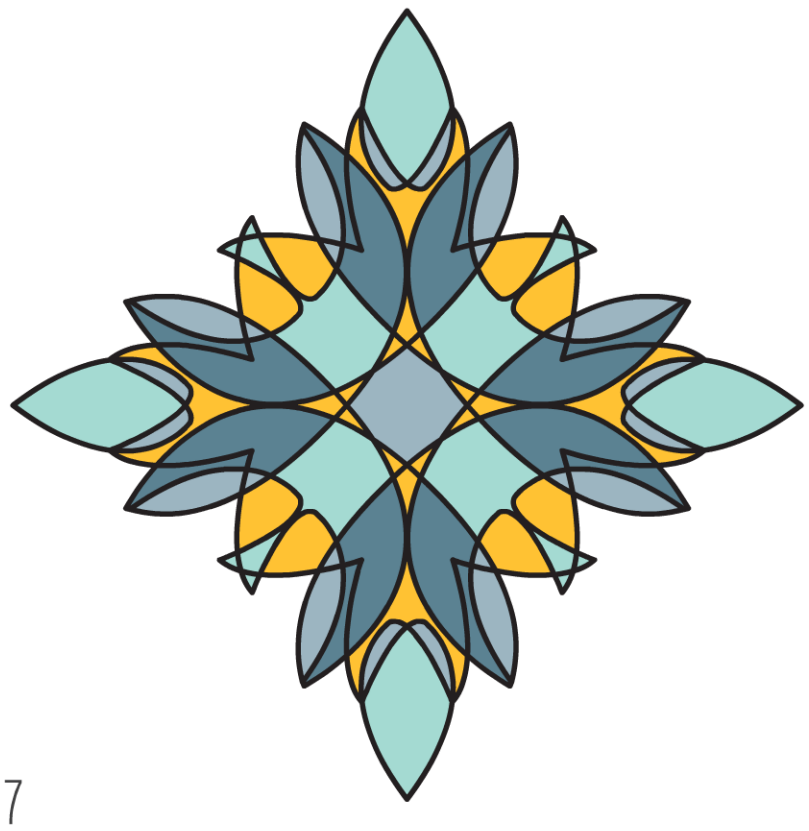

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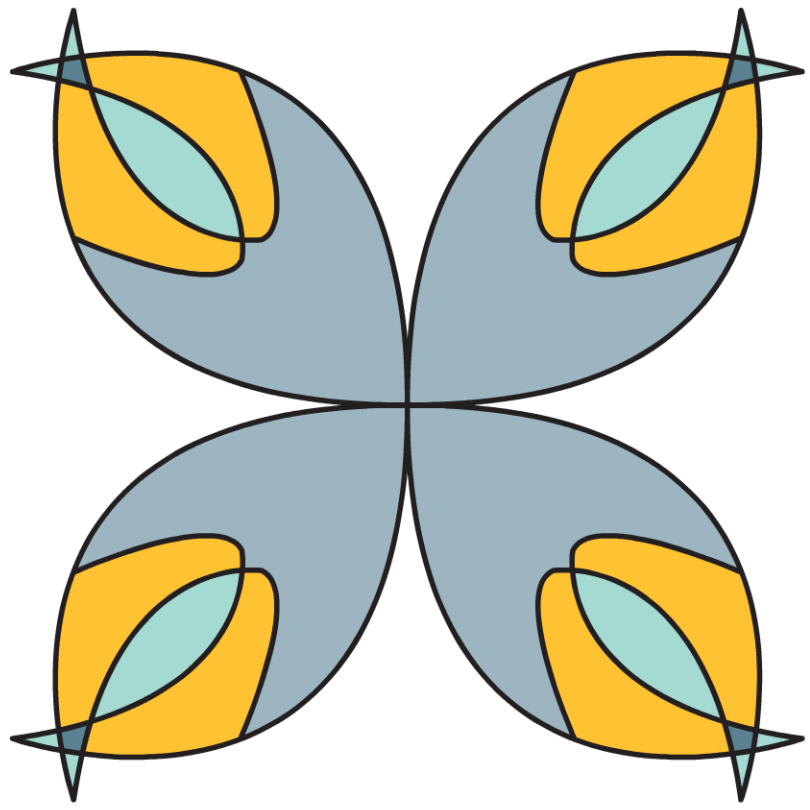

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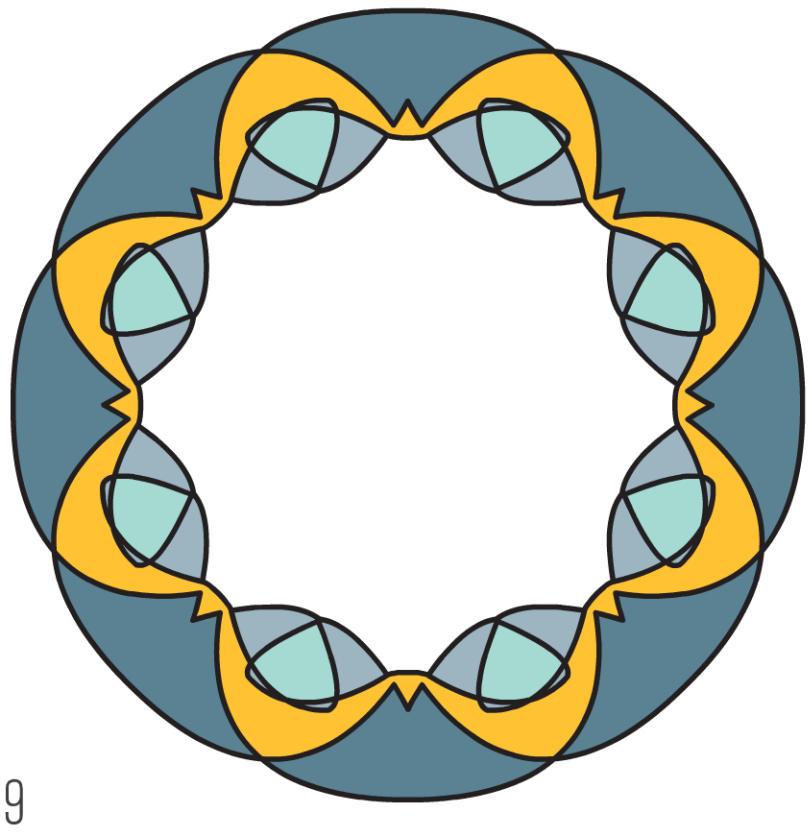
Double Horn



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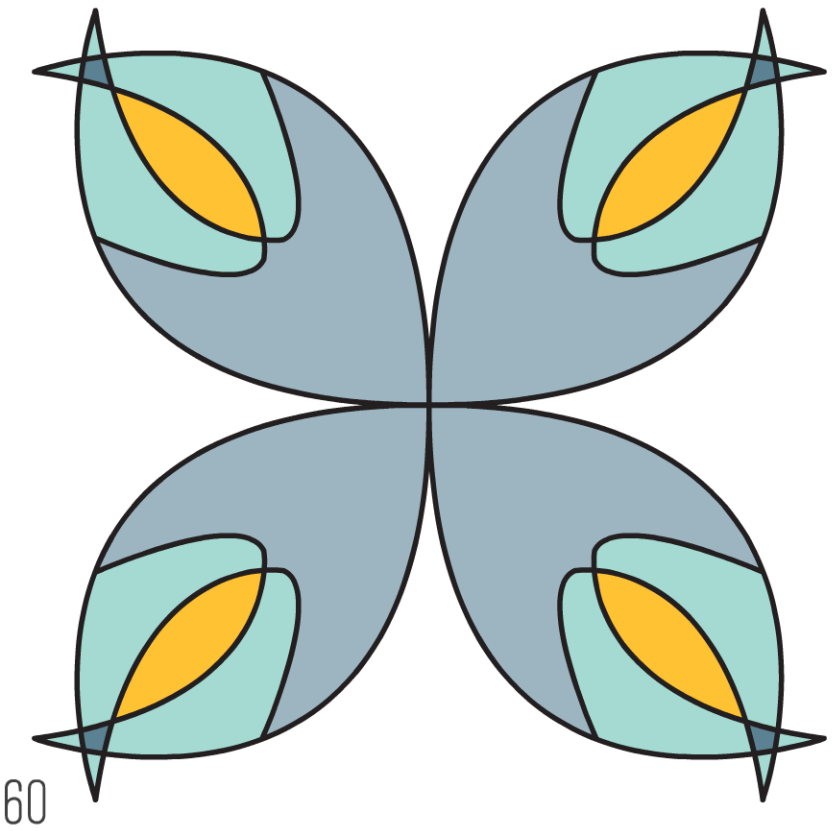

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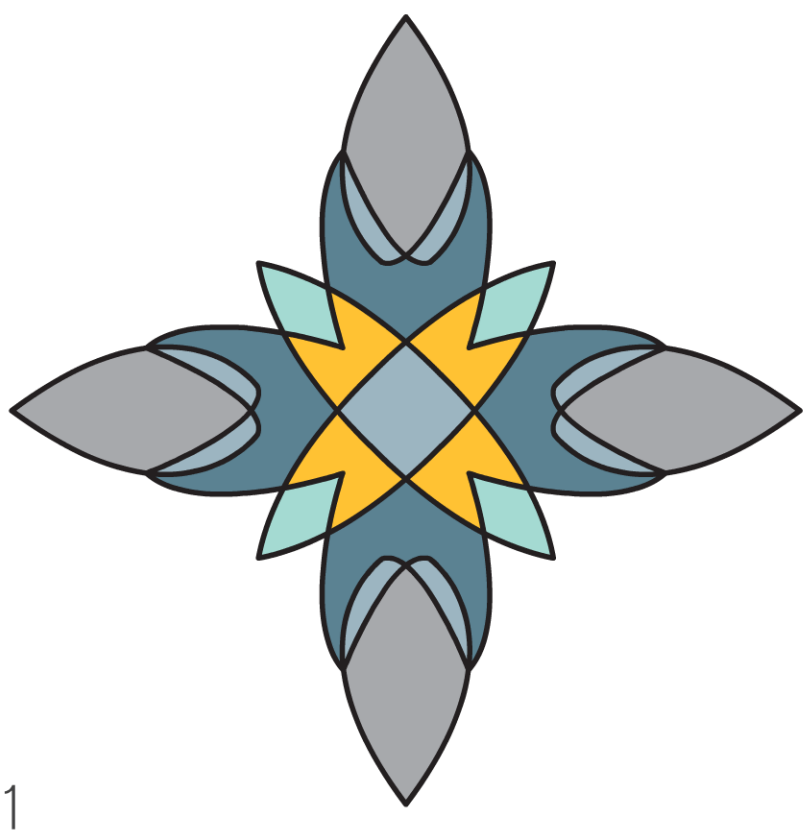

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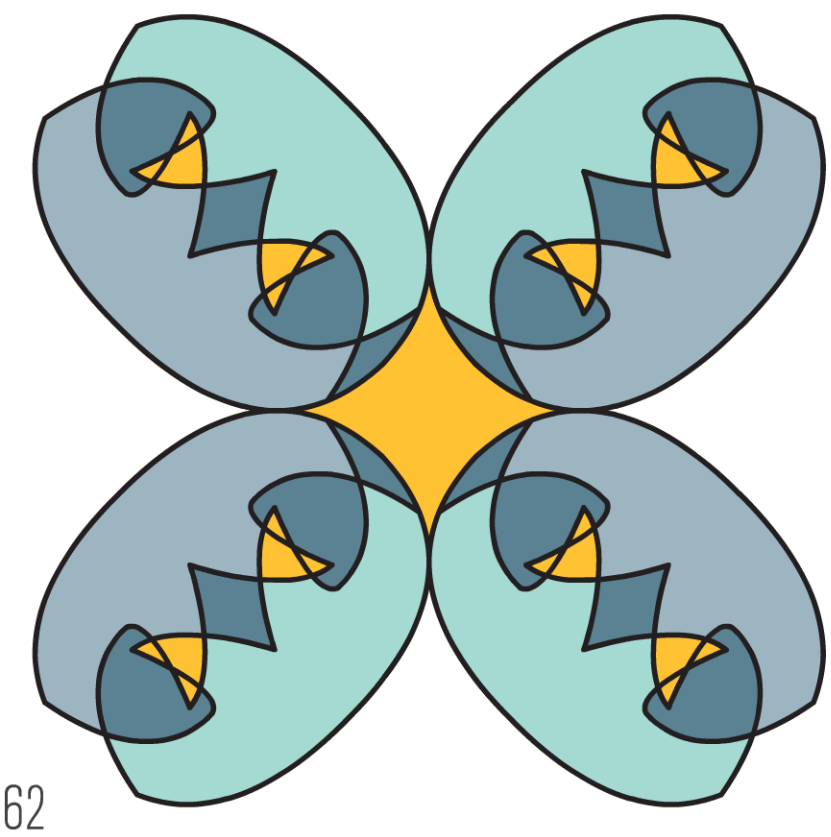

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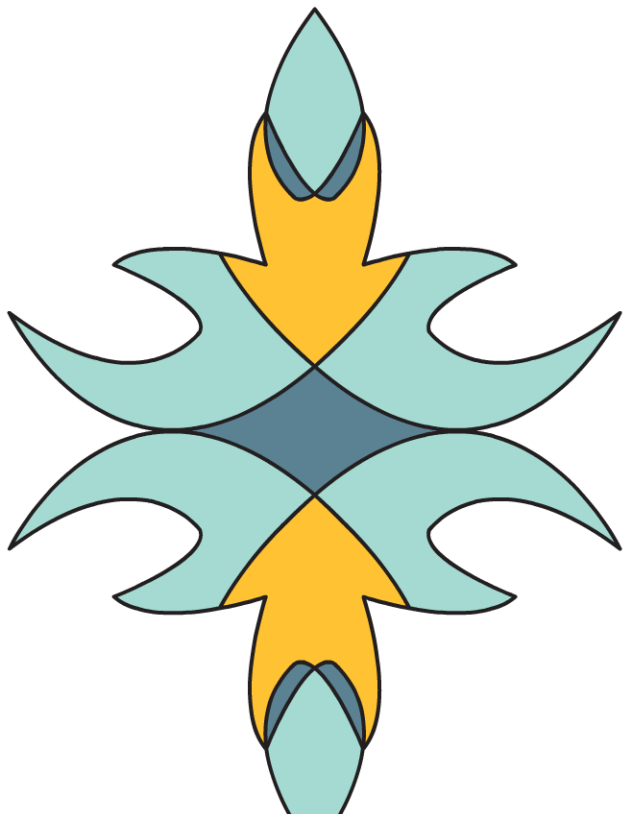

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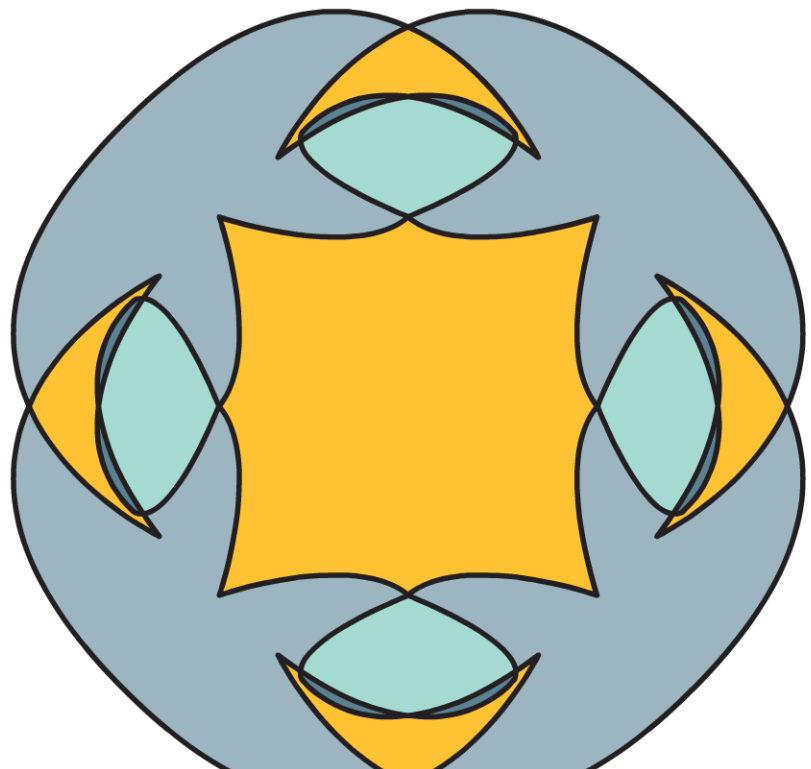
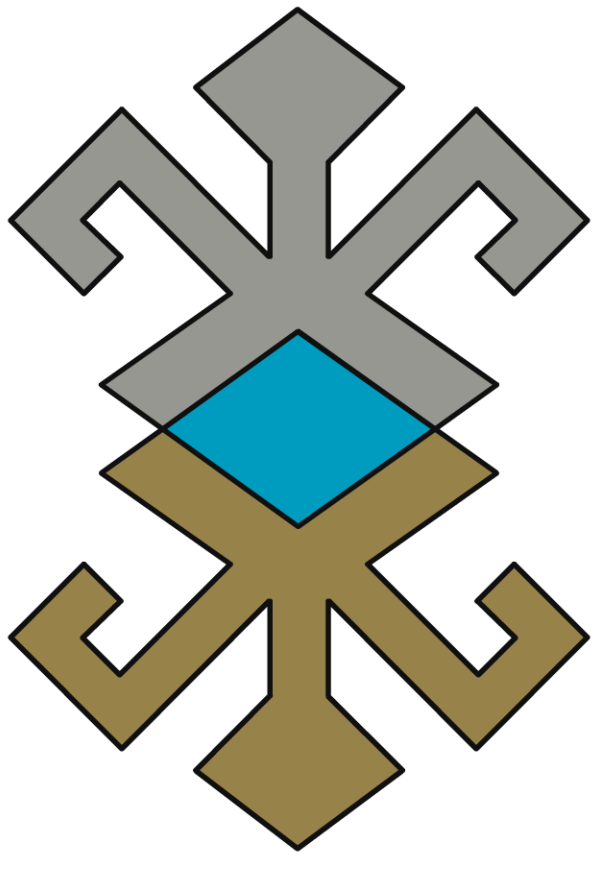


264

Down at Arms



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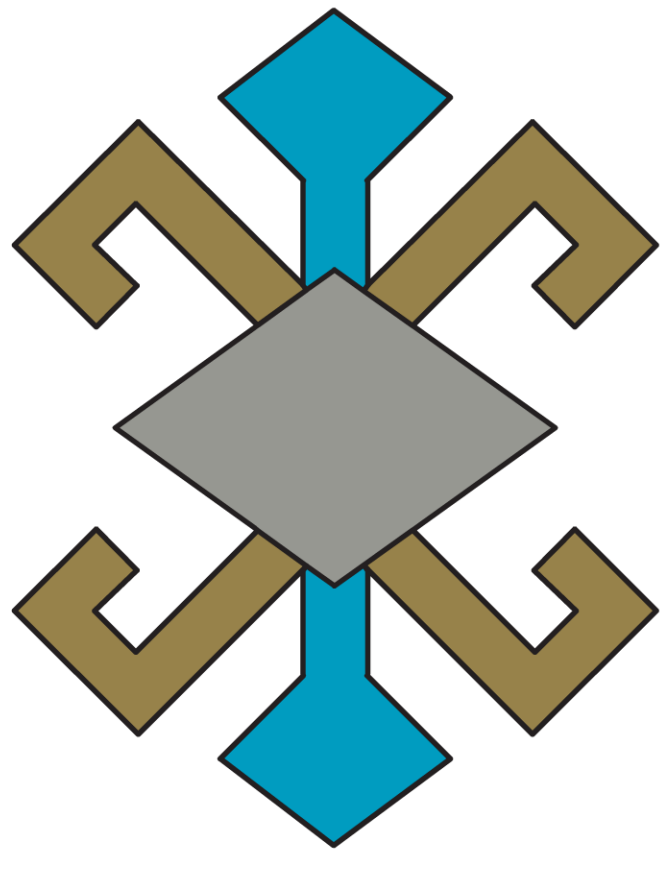

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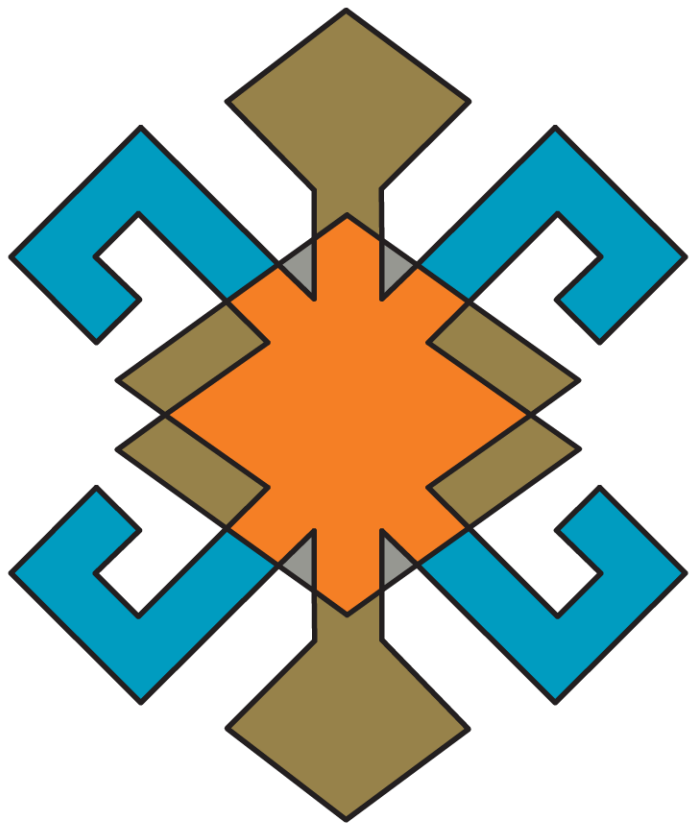

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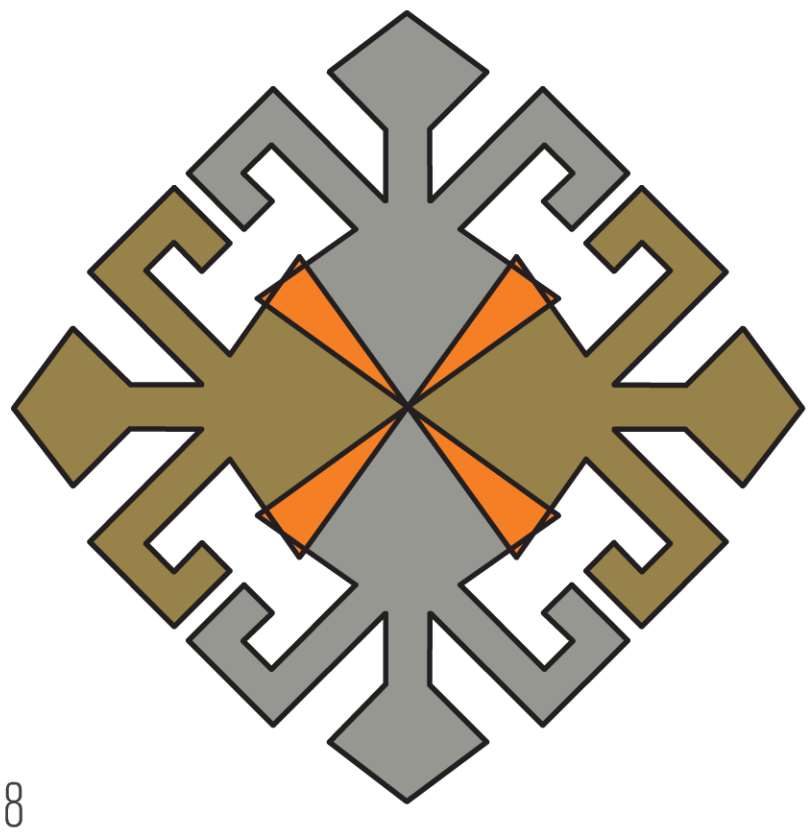

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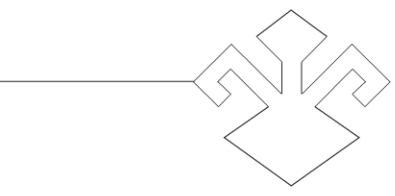
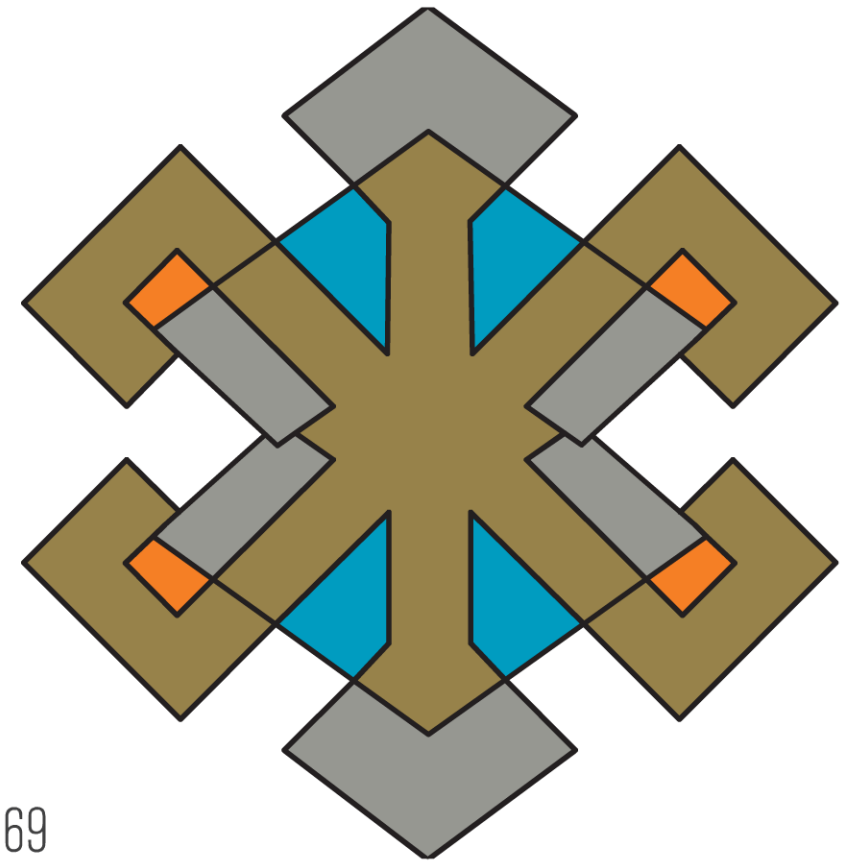


Down at Arms



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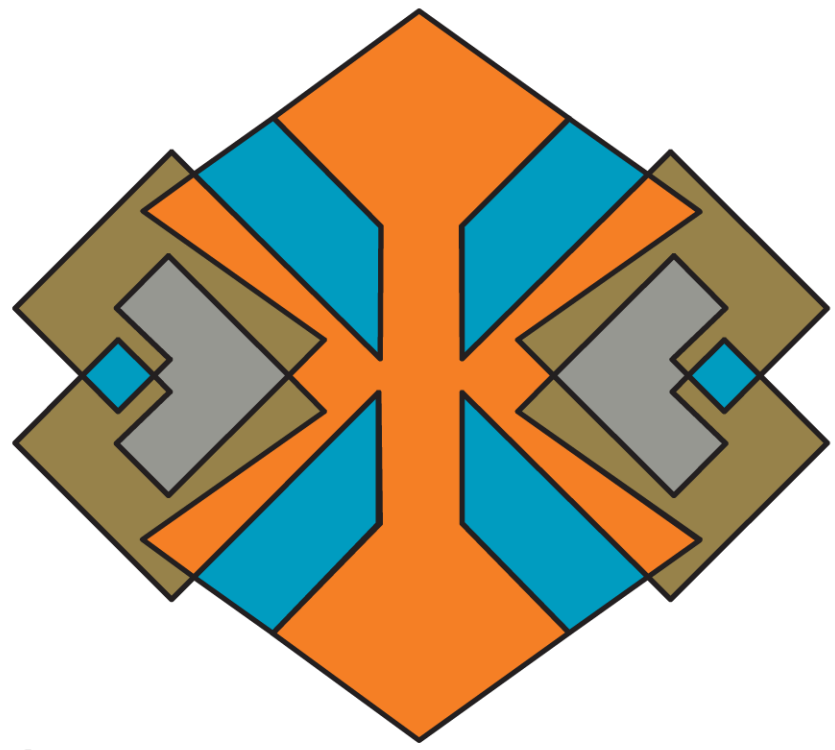

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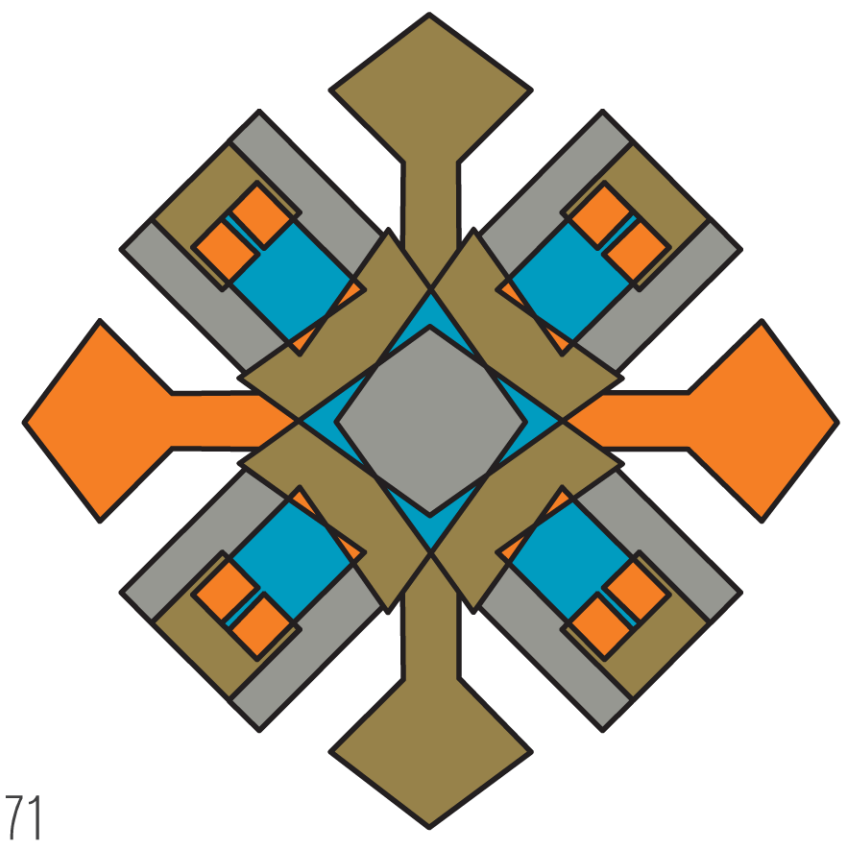

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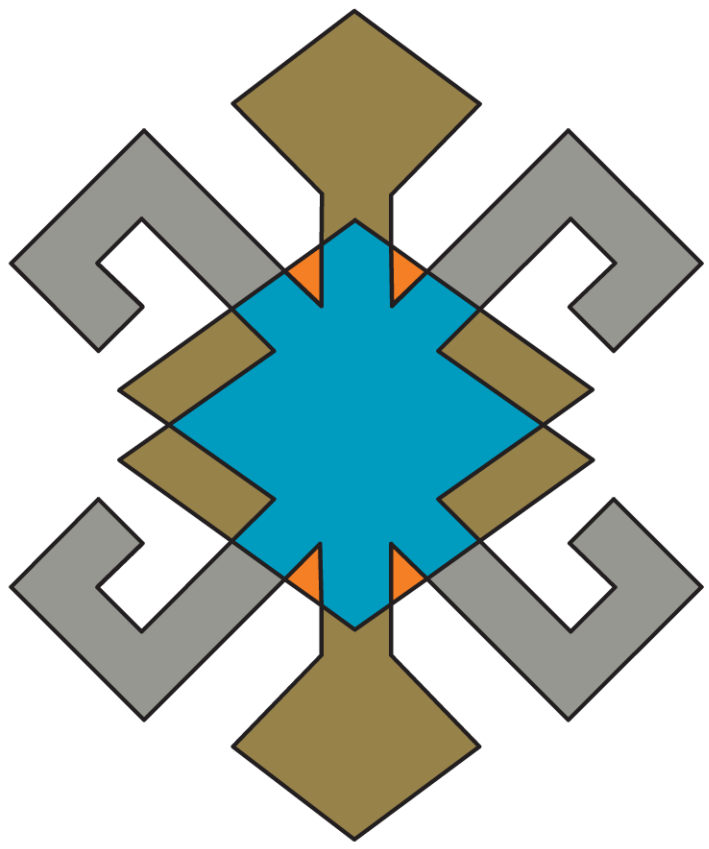

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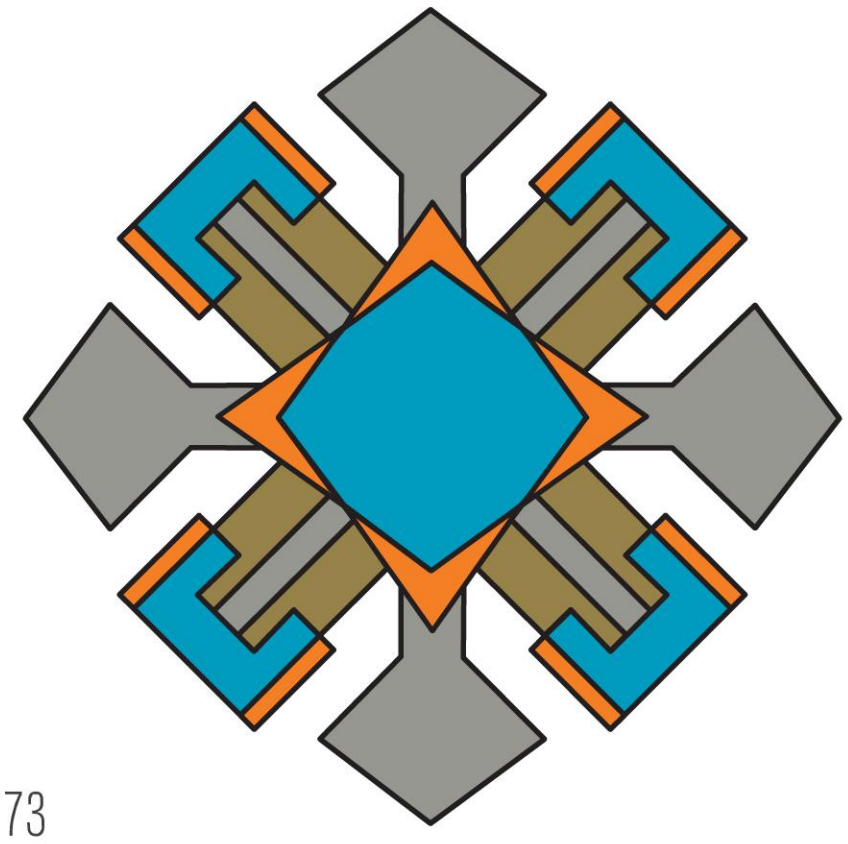

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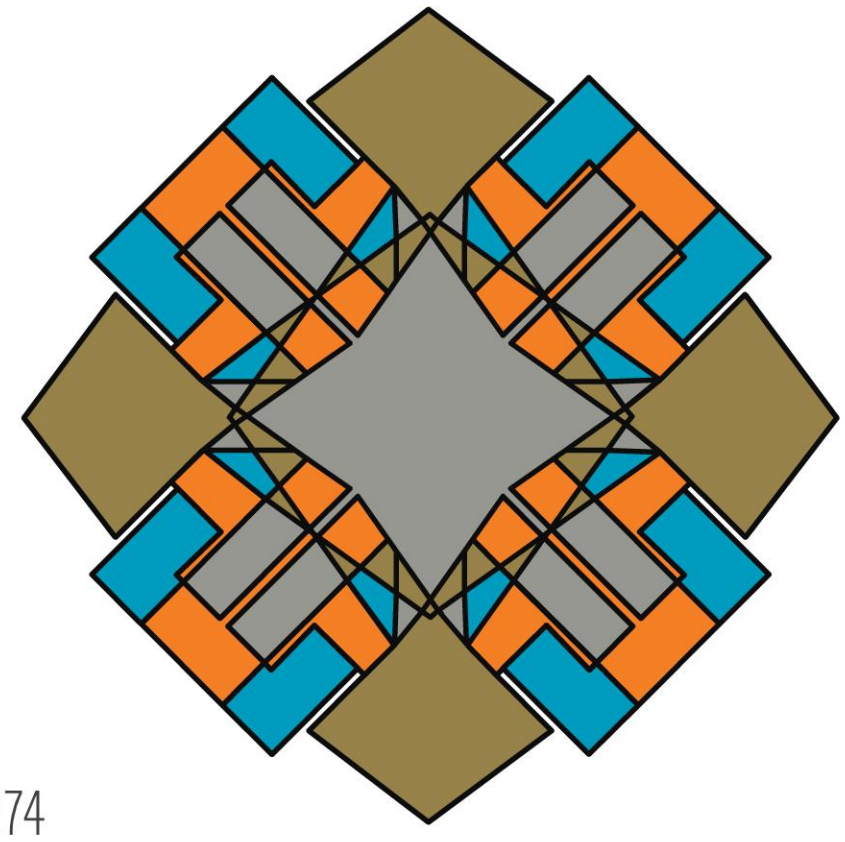

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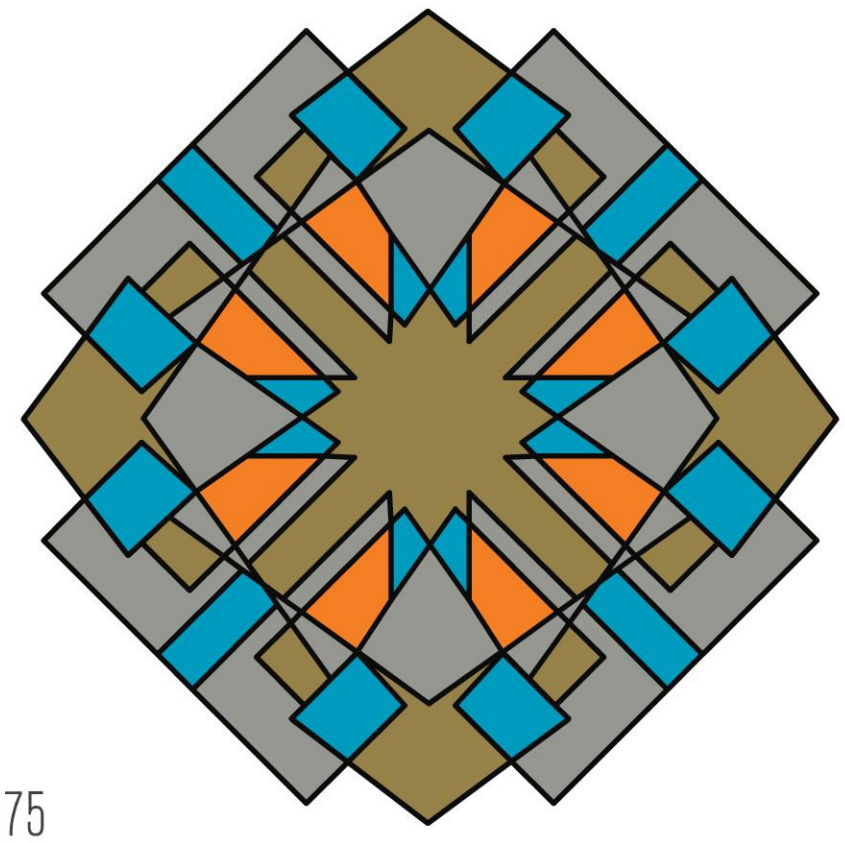

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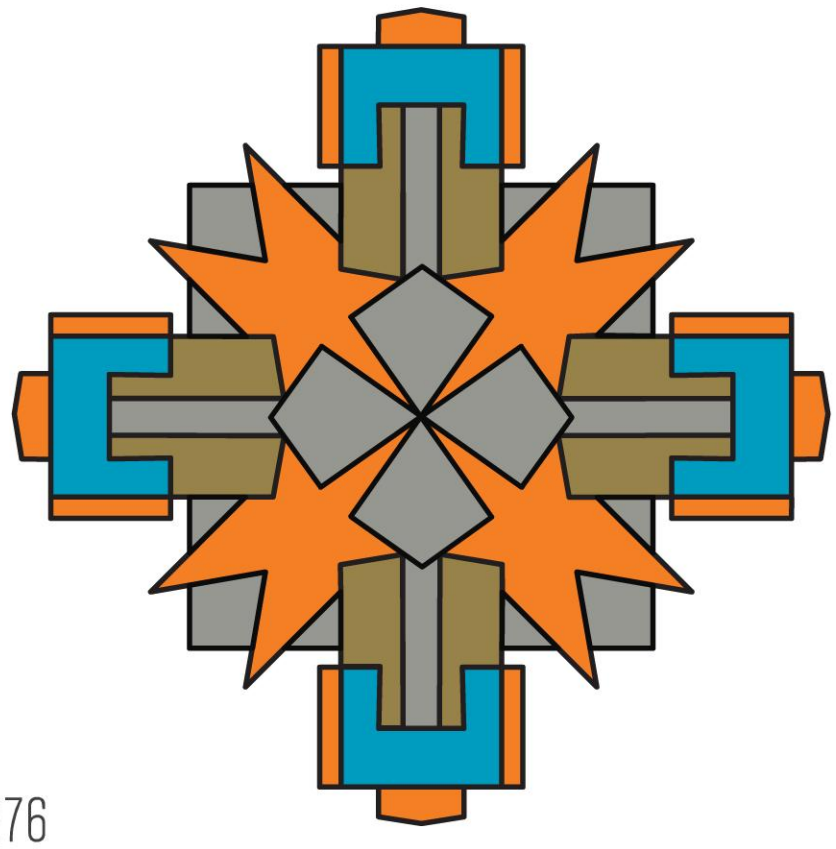

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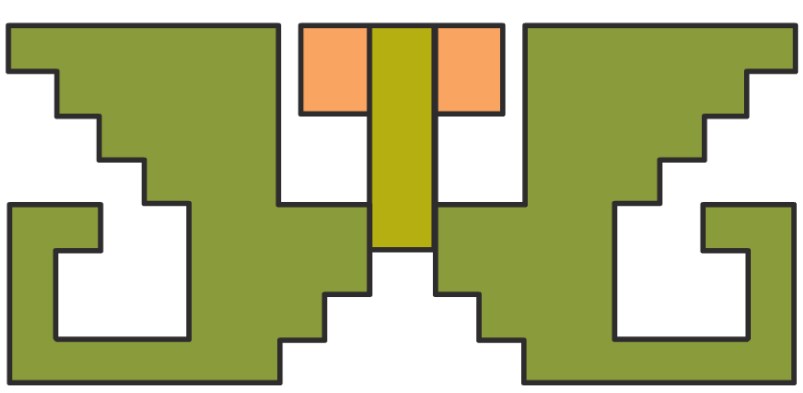
Dragons



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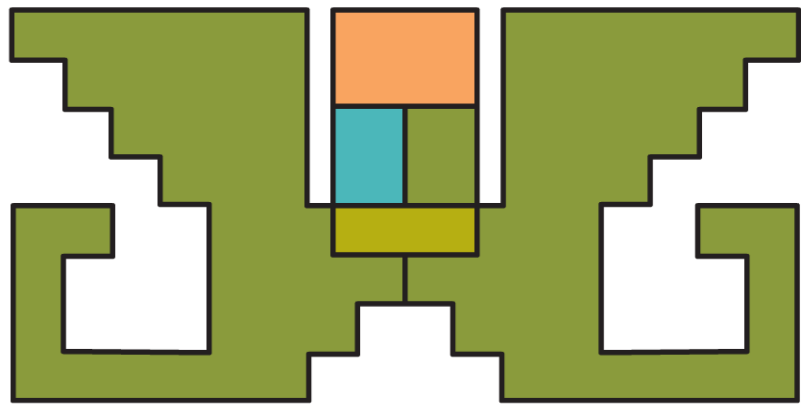

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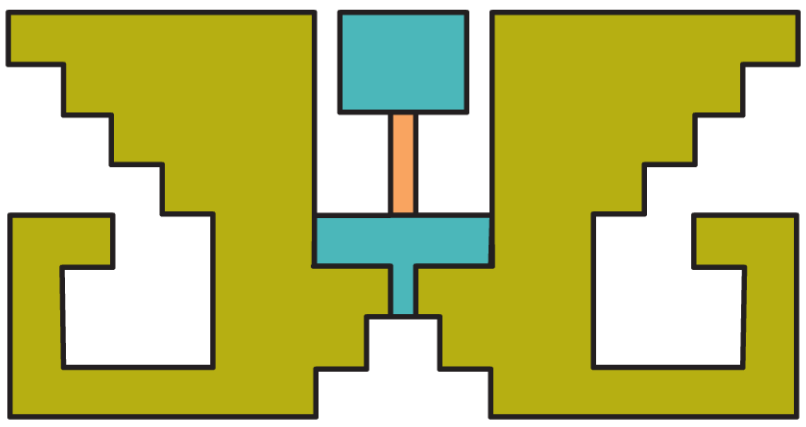

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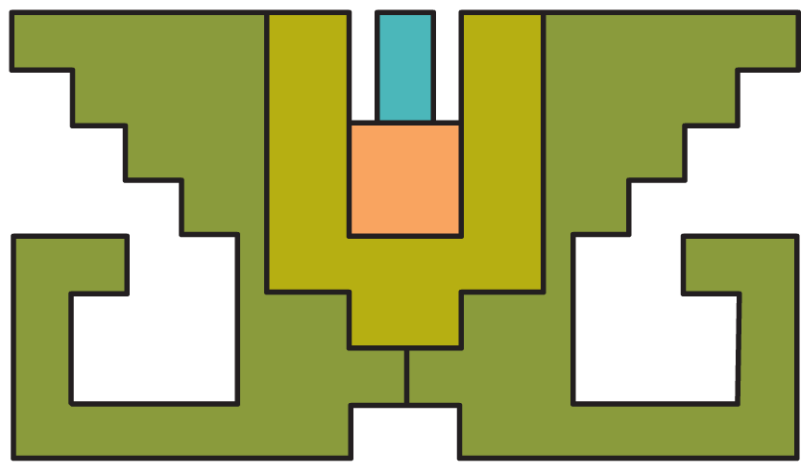

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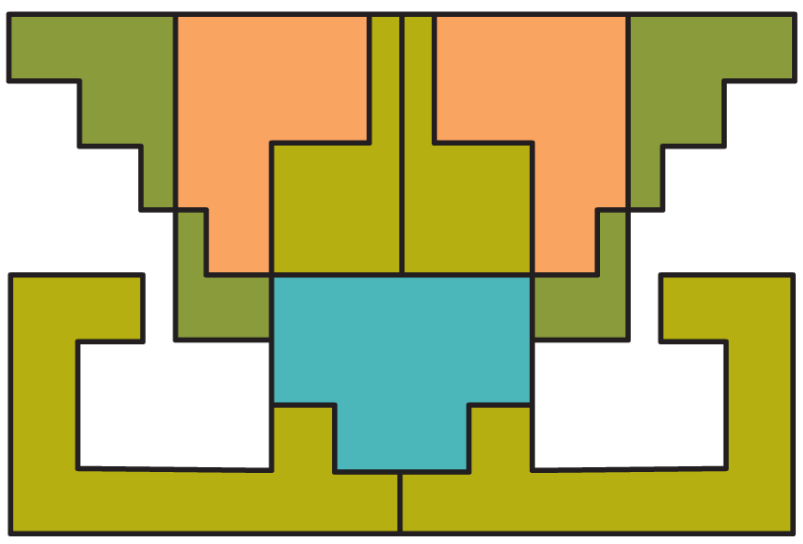

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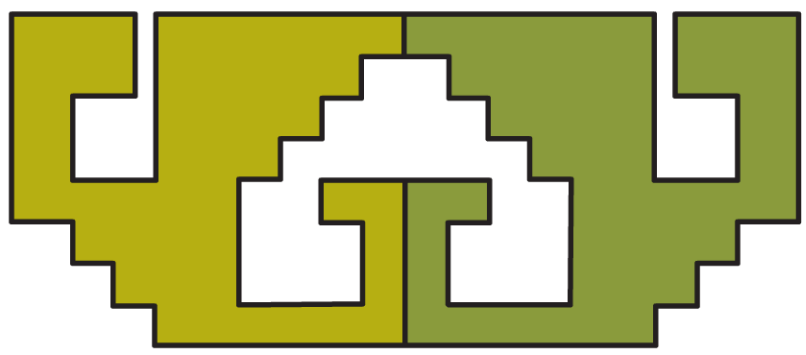

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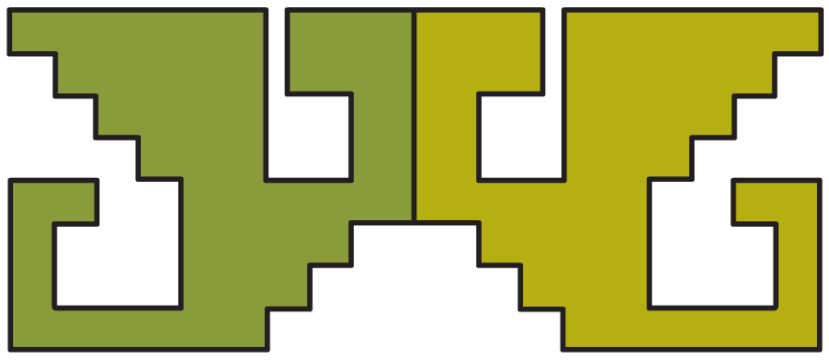

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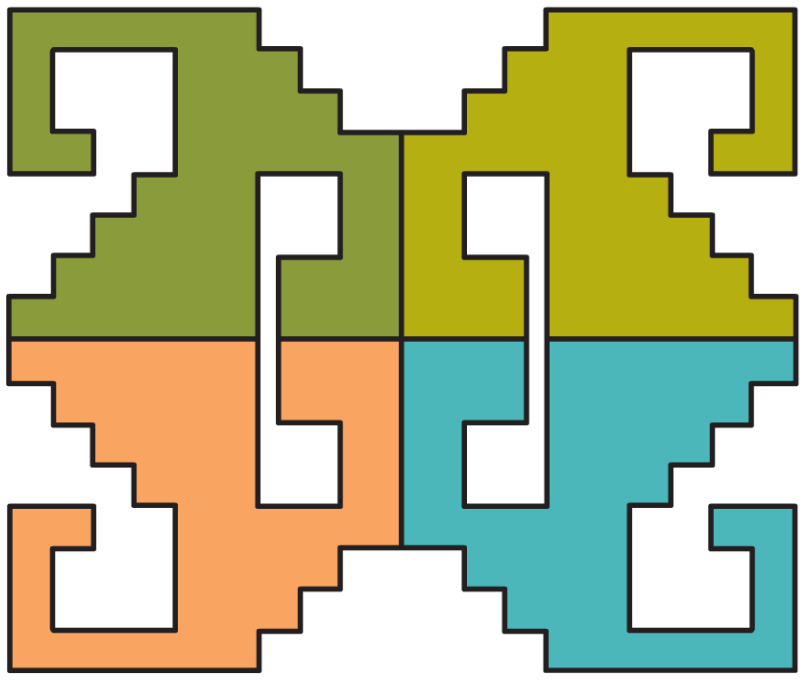

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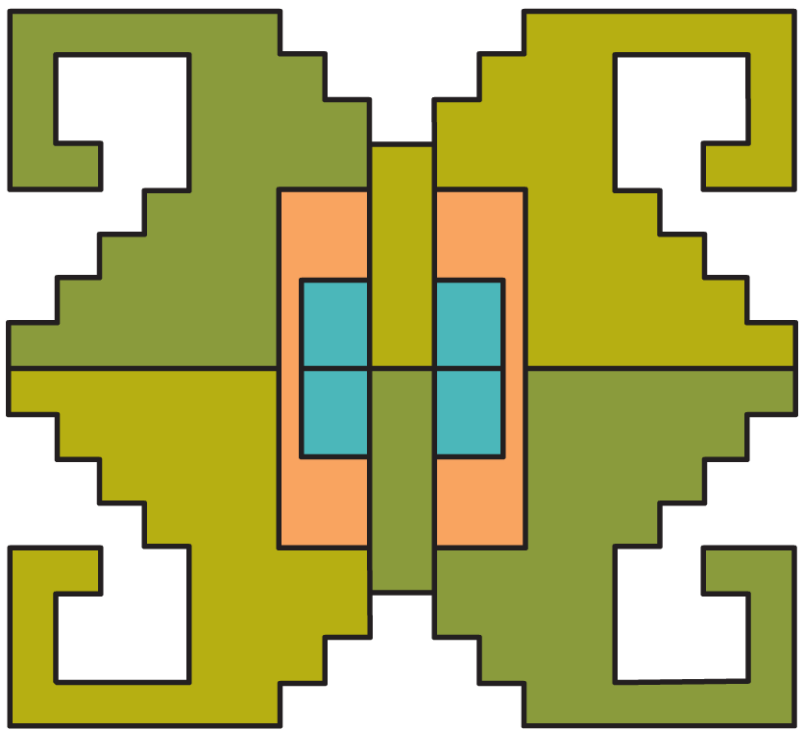

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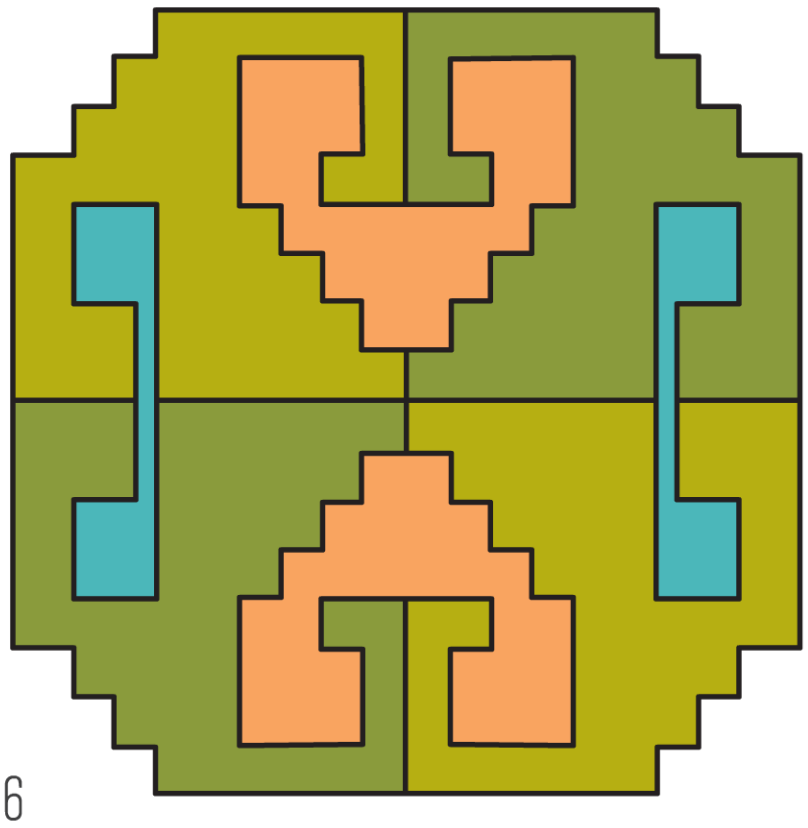

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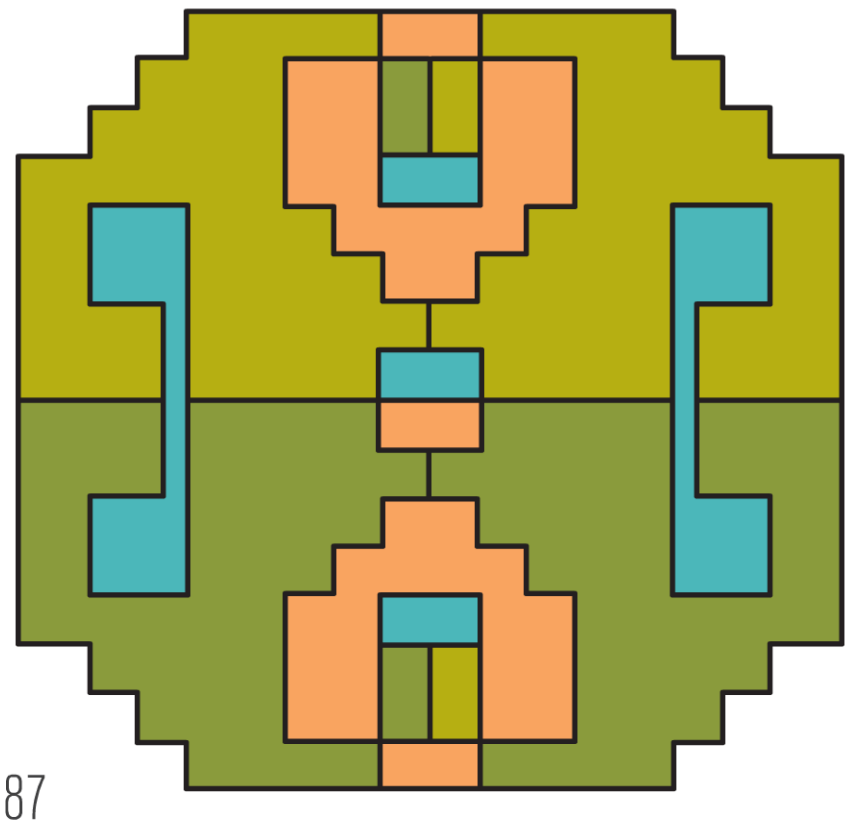

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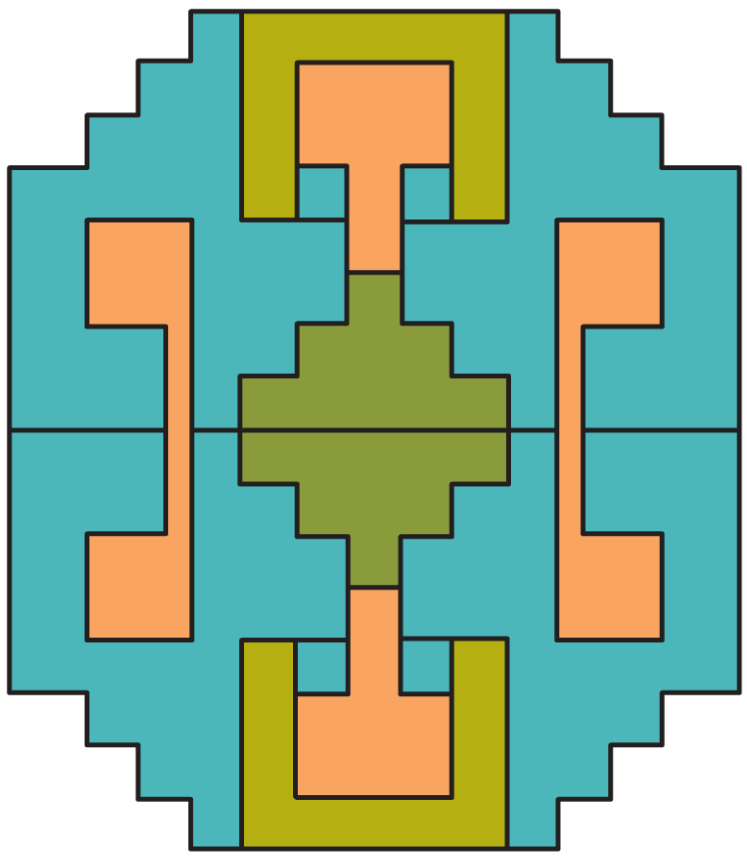

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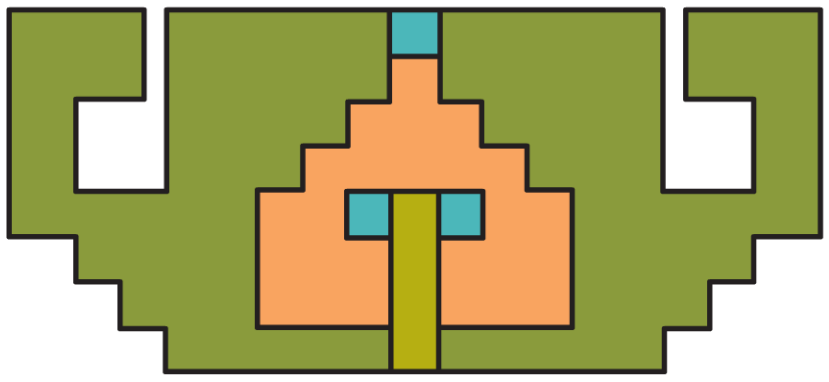

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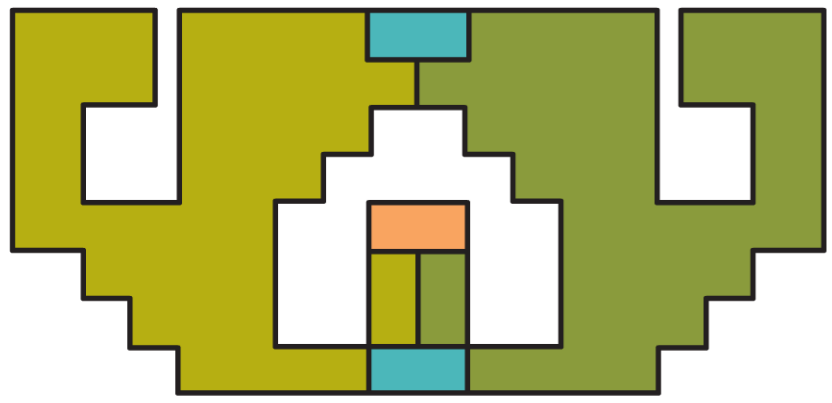

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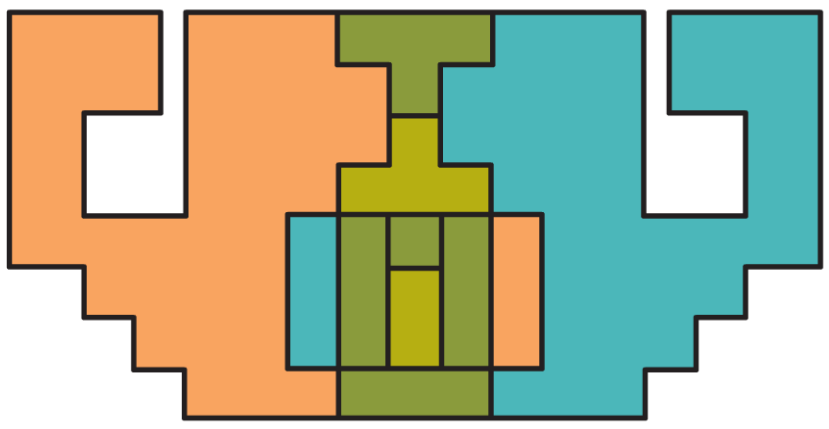

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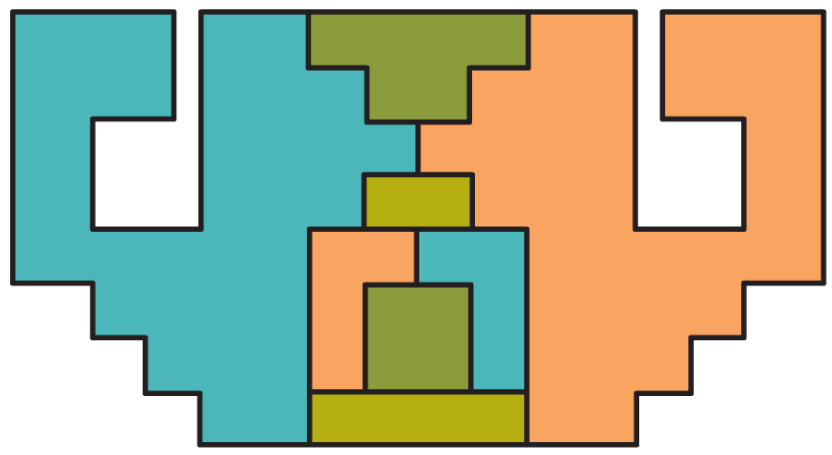

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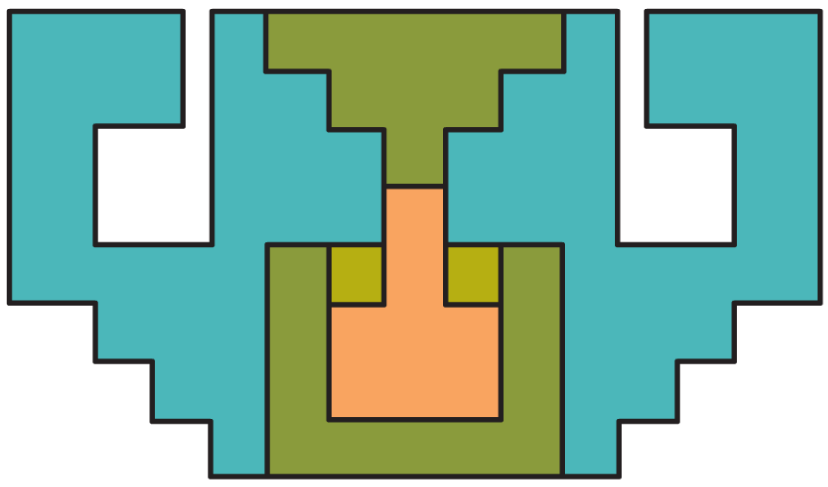

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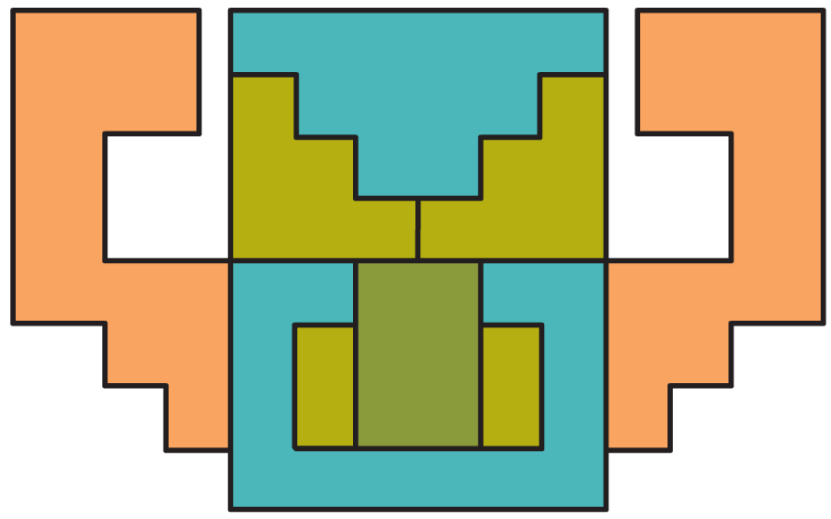

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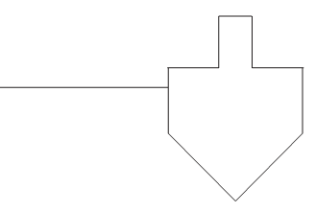

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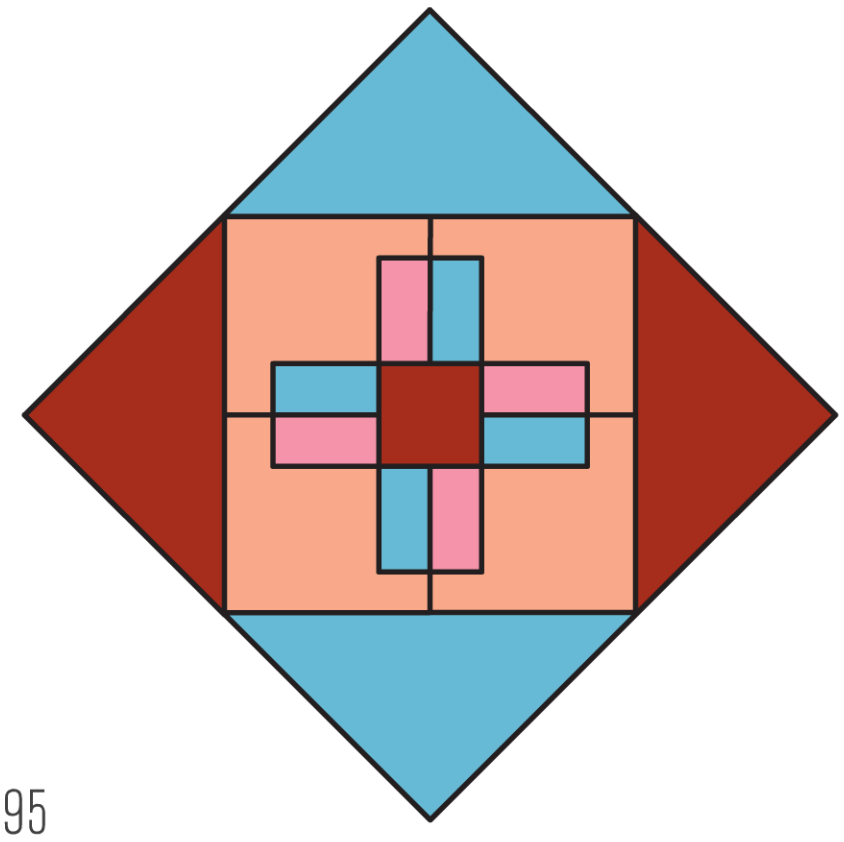

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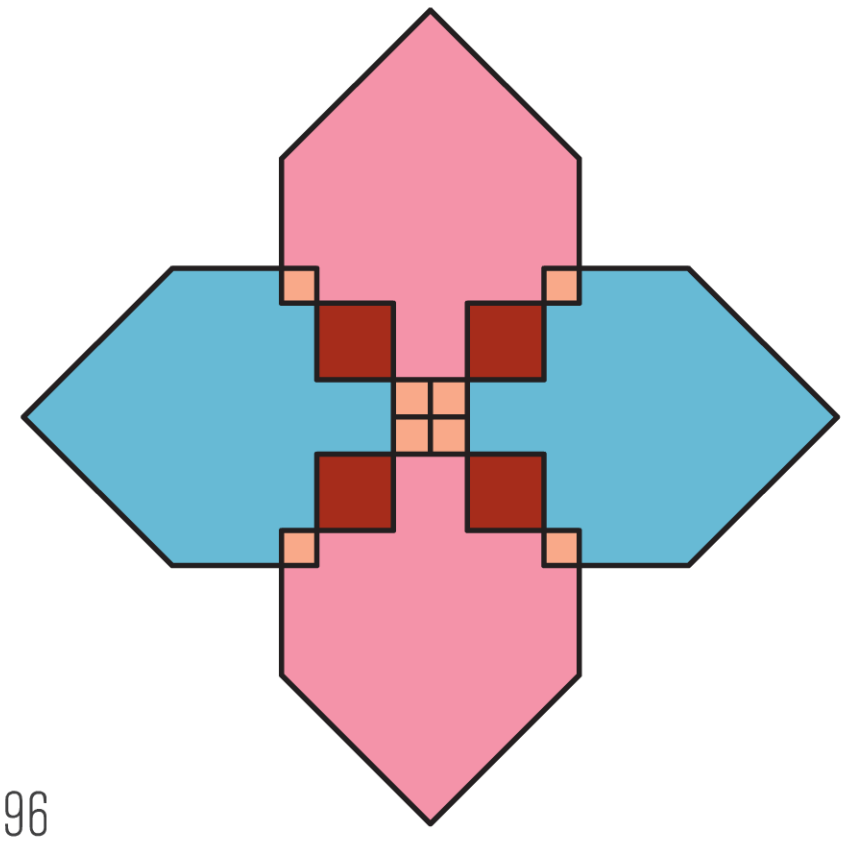

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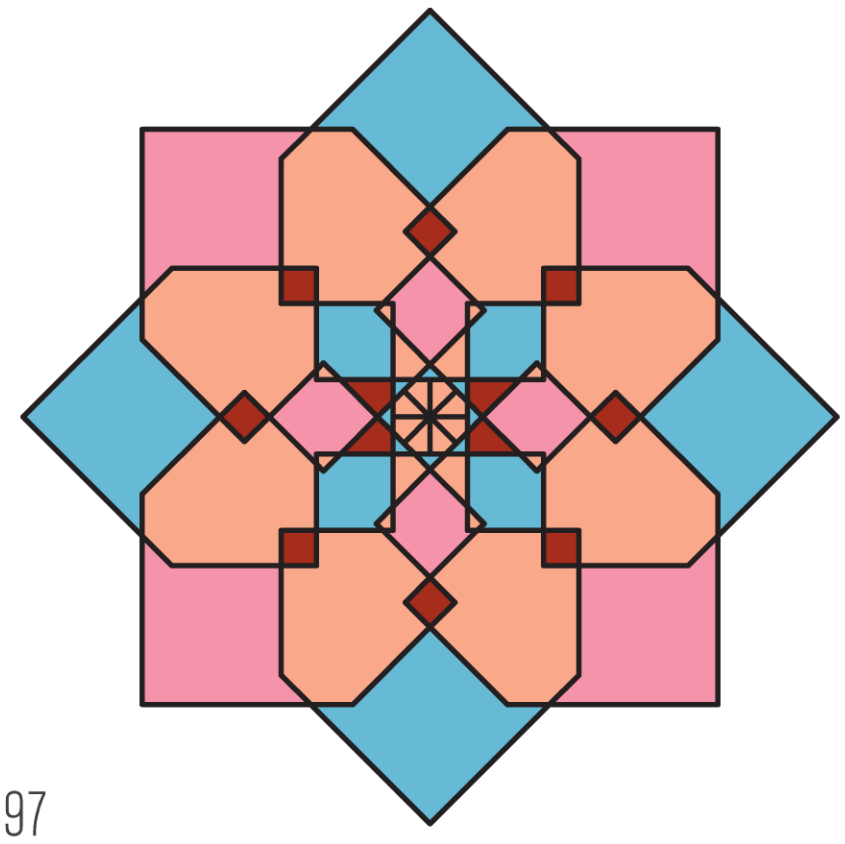

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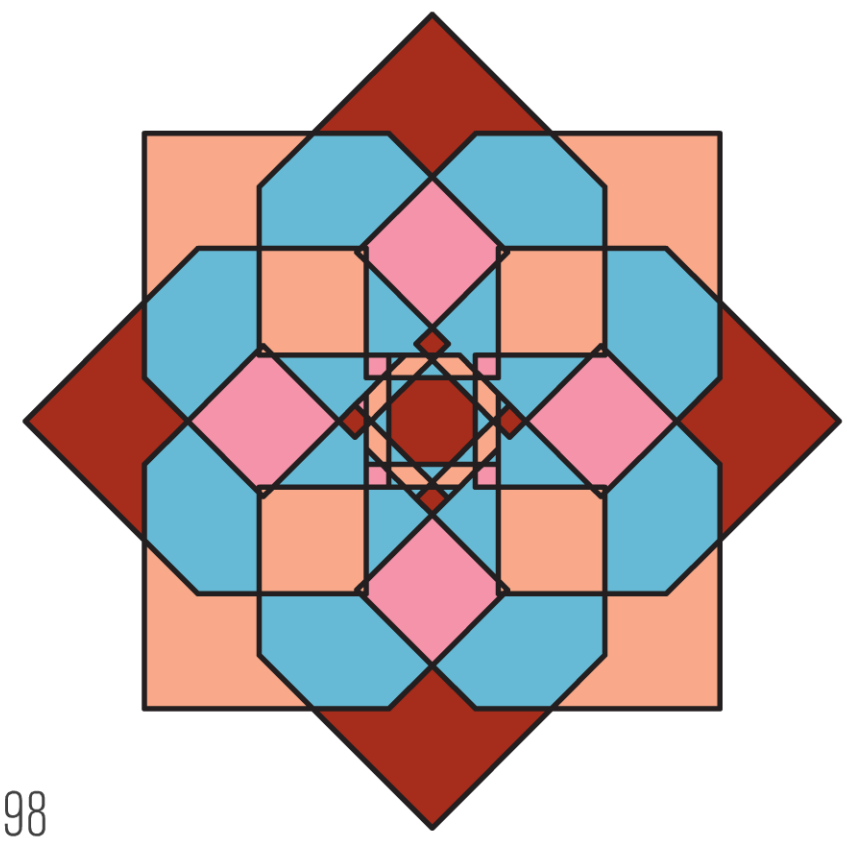

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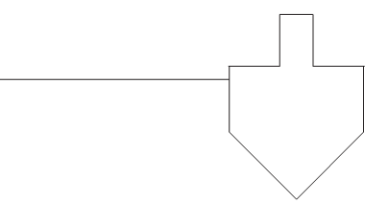
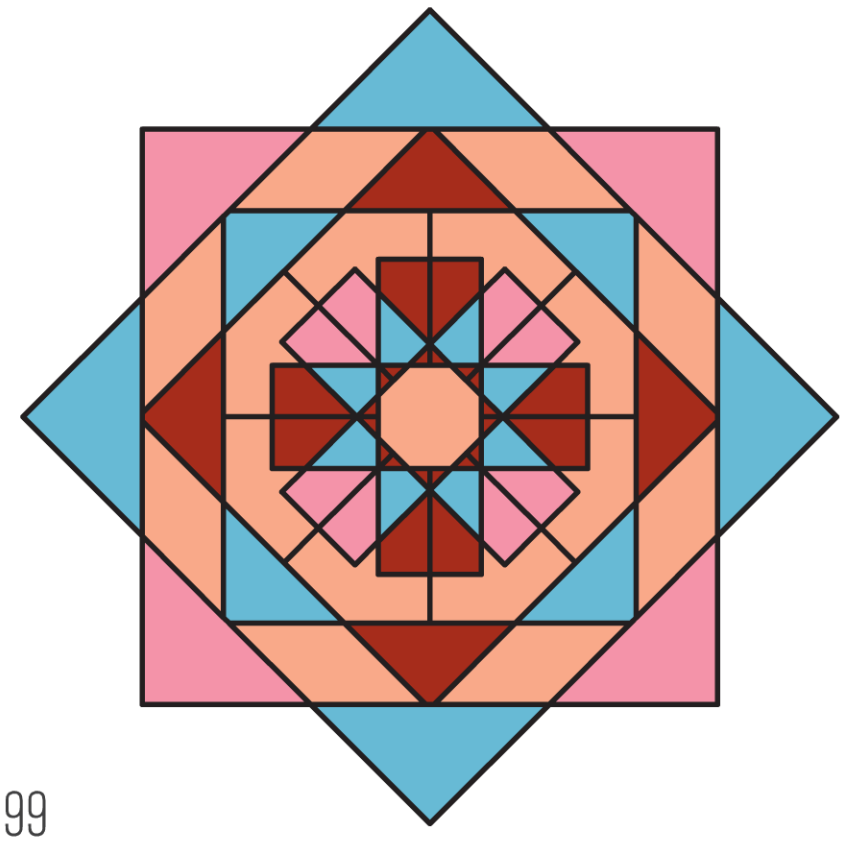


Dreidels



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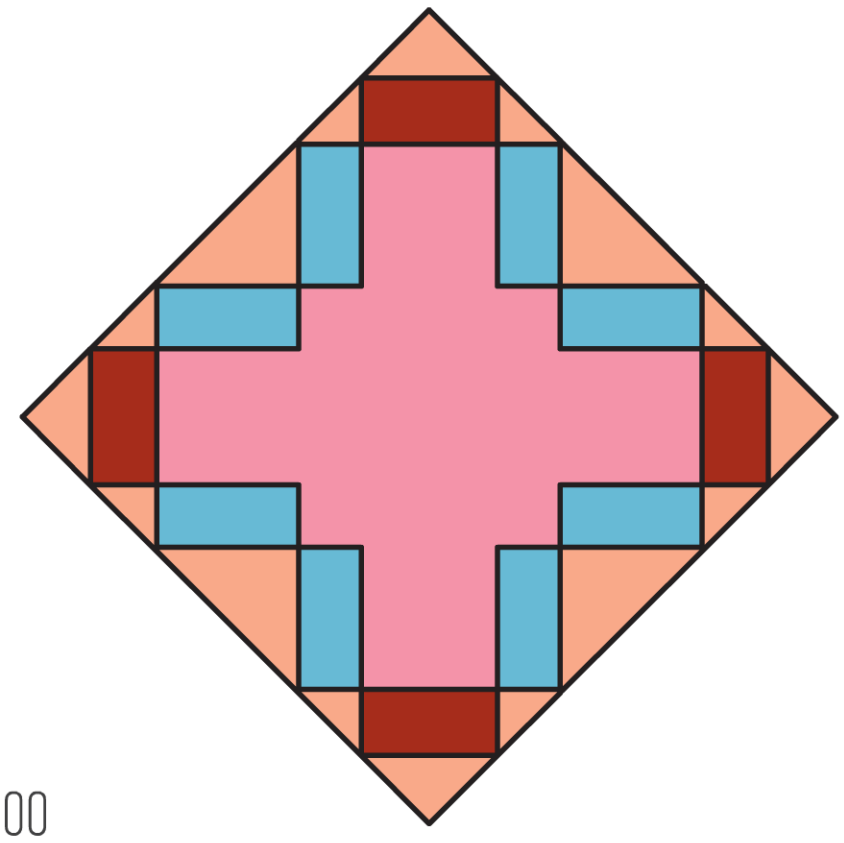

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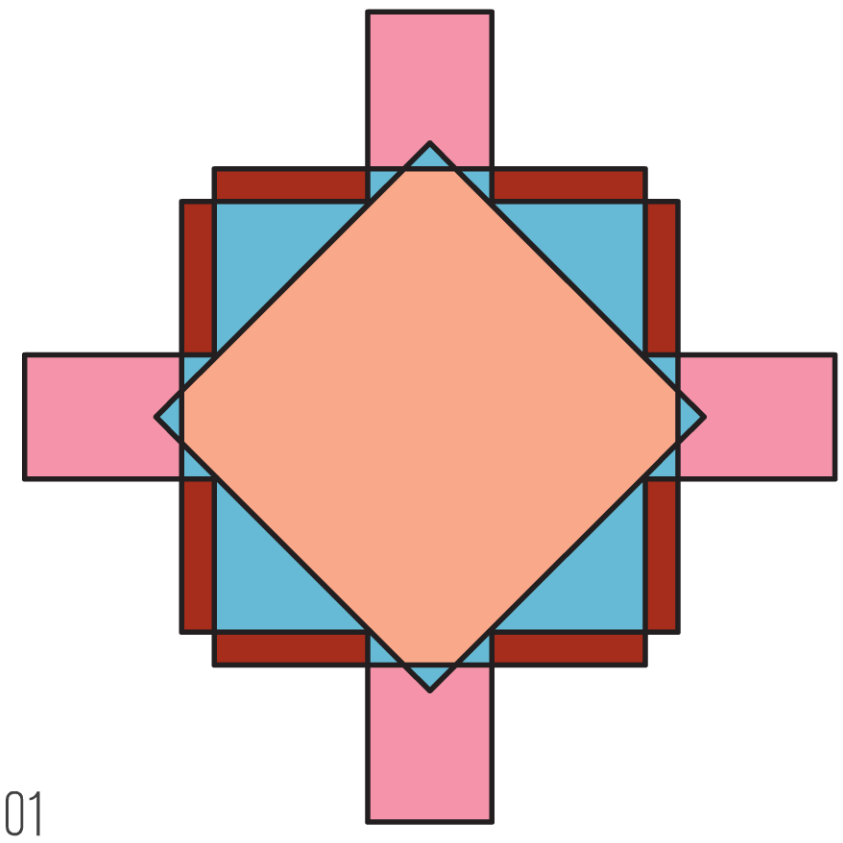

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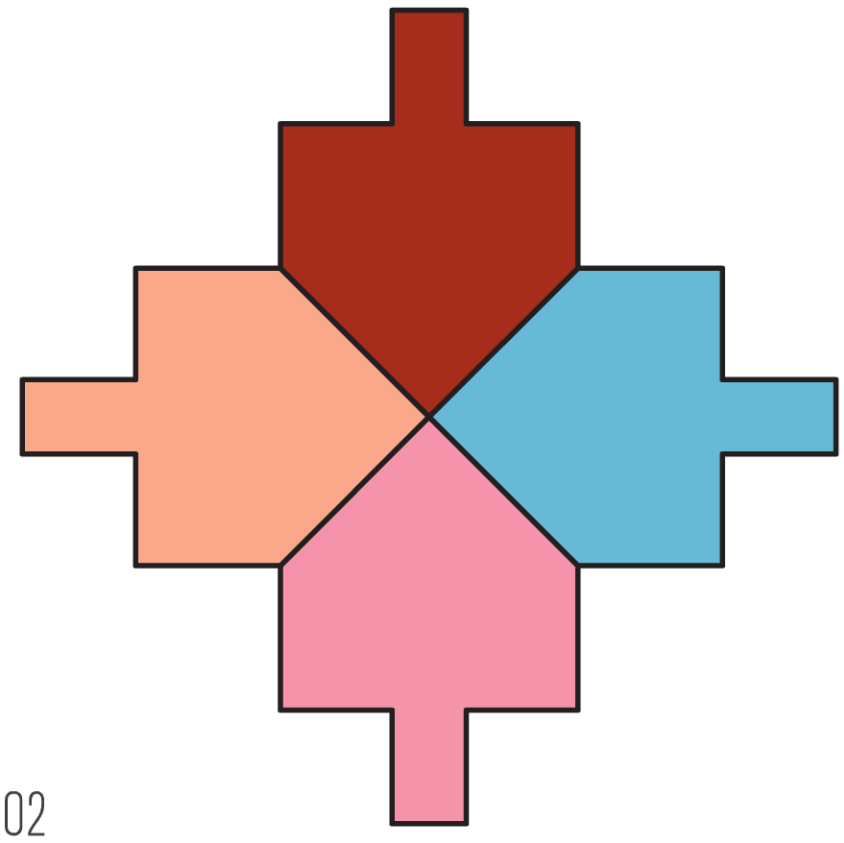

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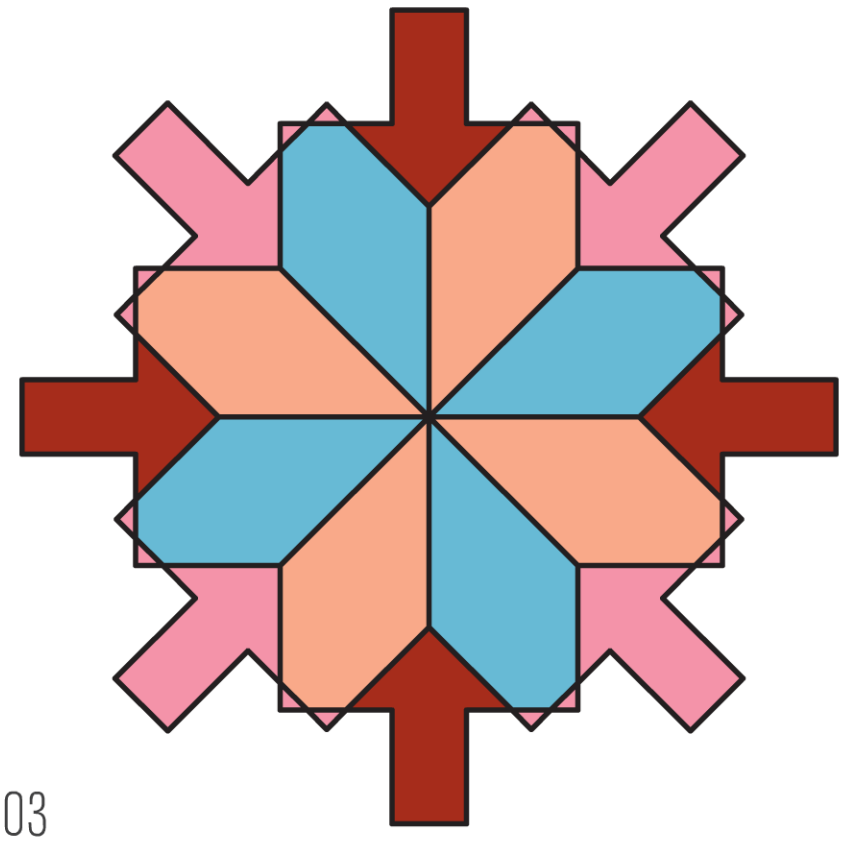

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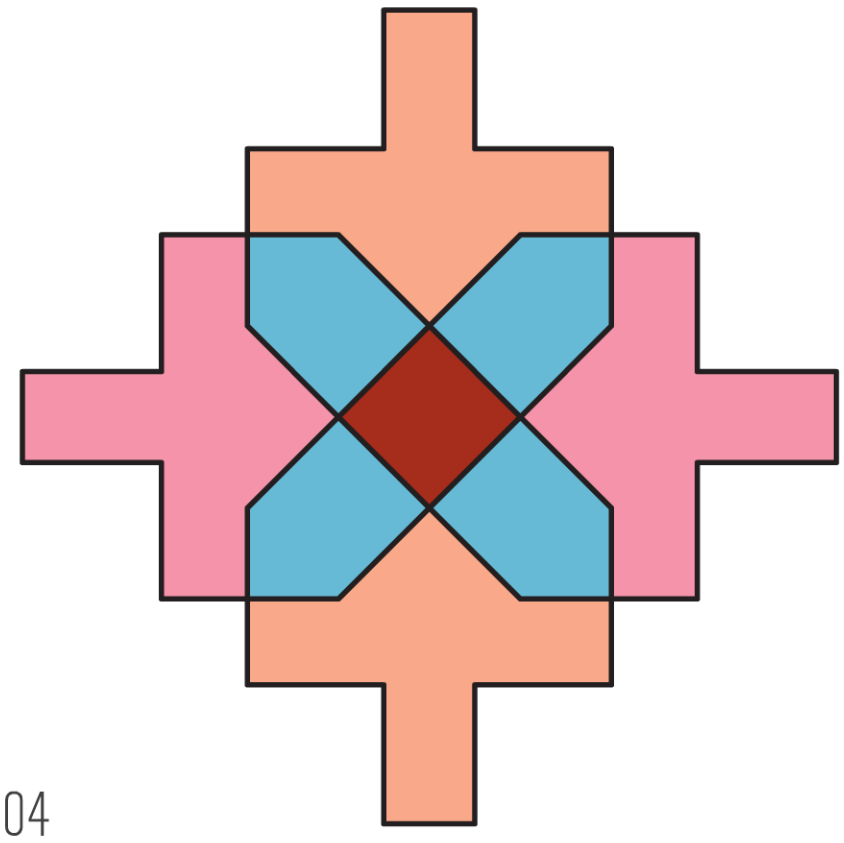

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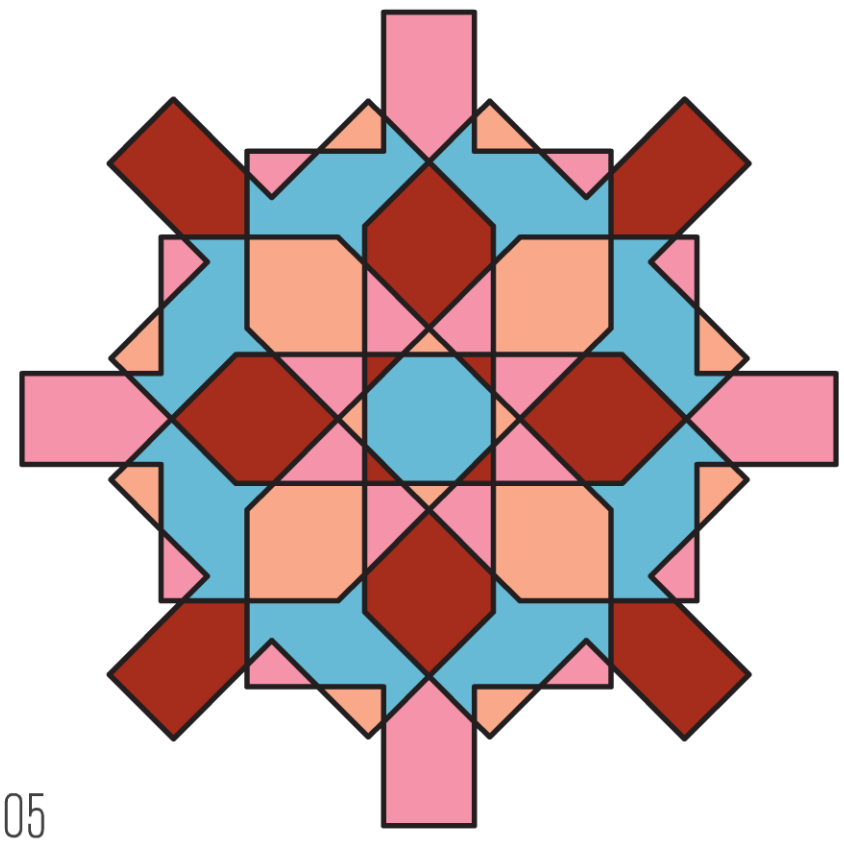

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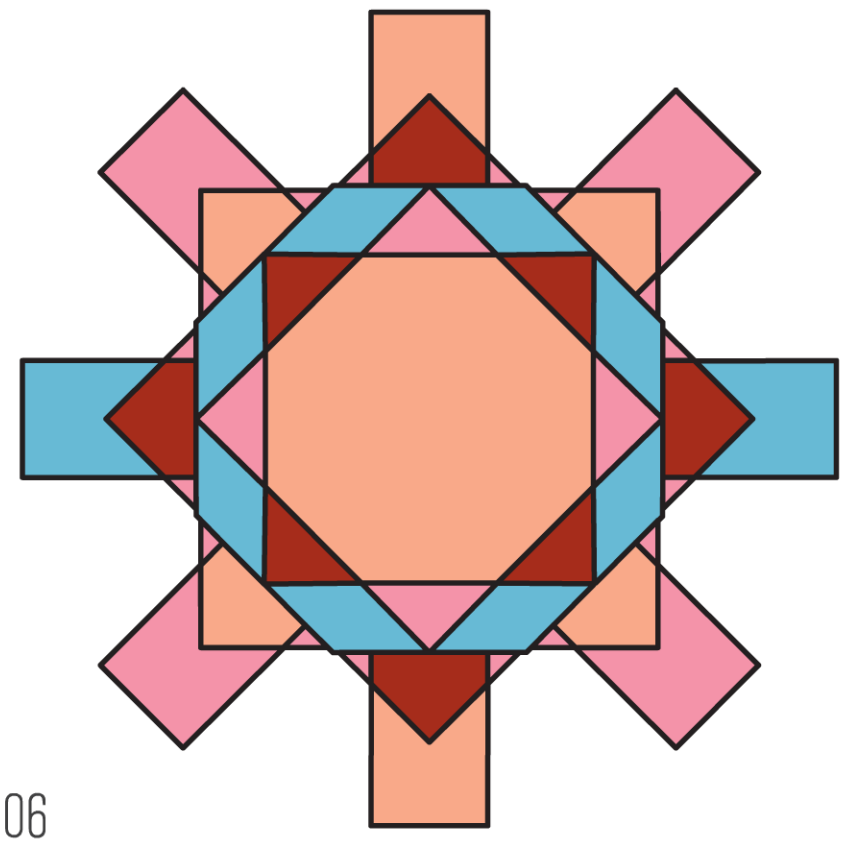

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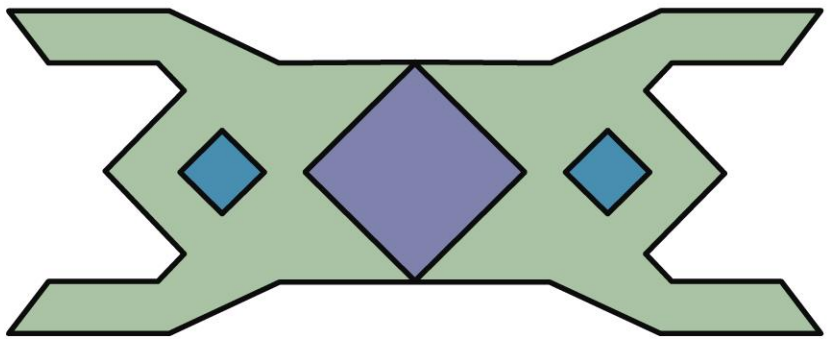
Eagle Eyes



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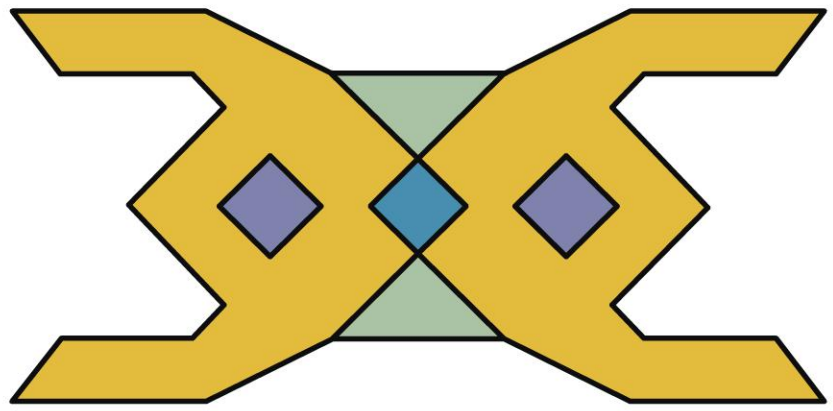

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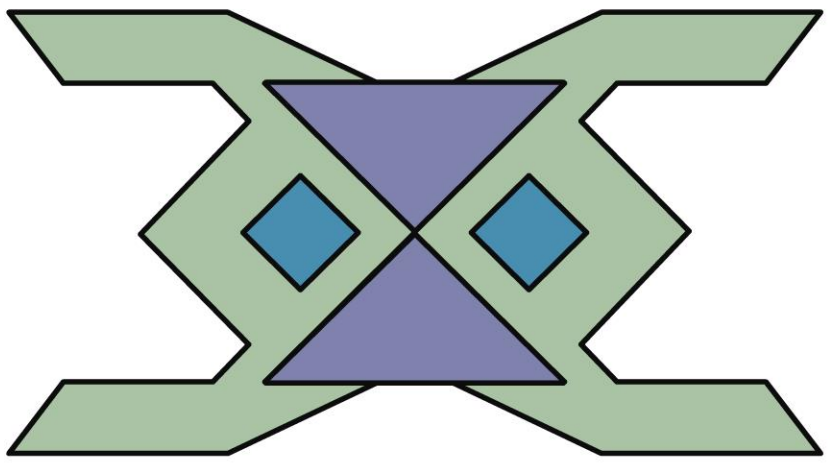

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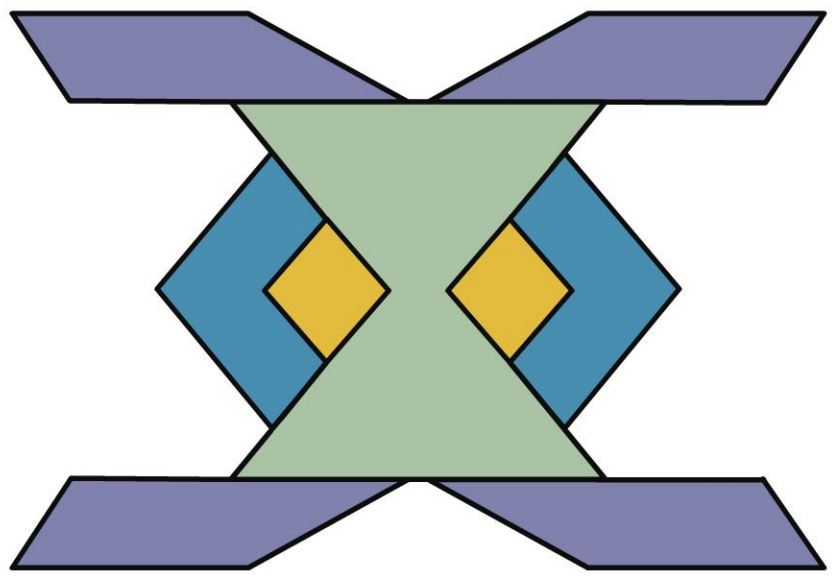

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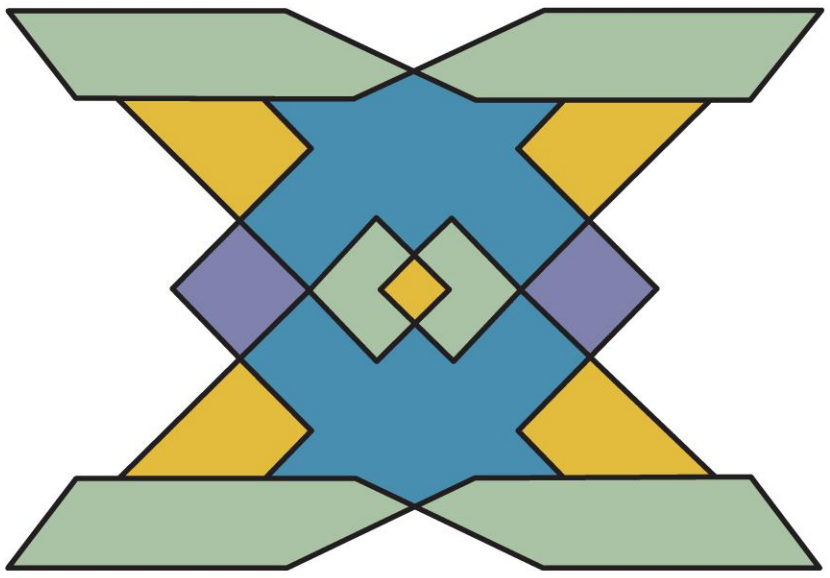

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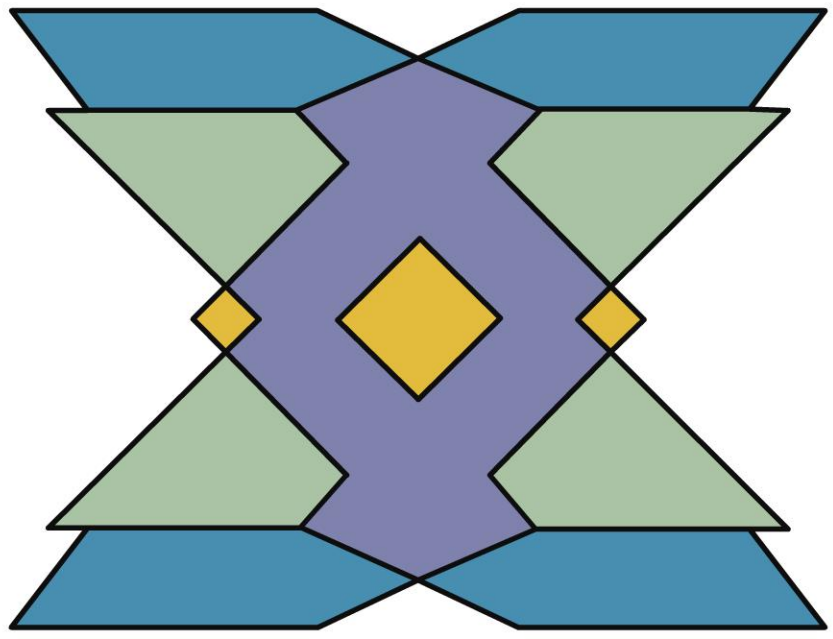

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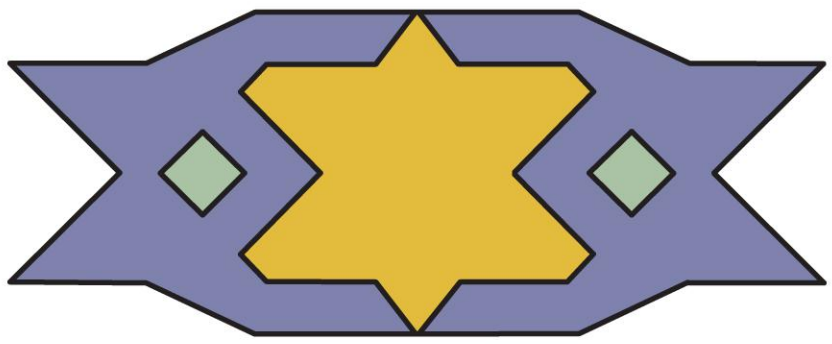

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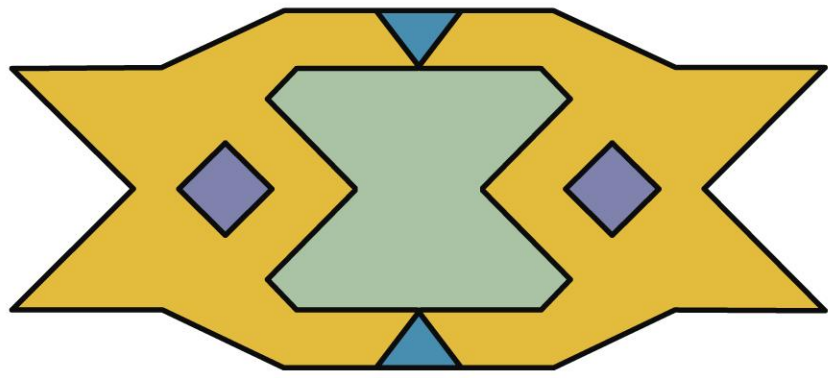

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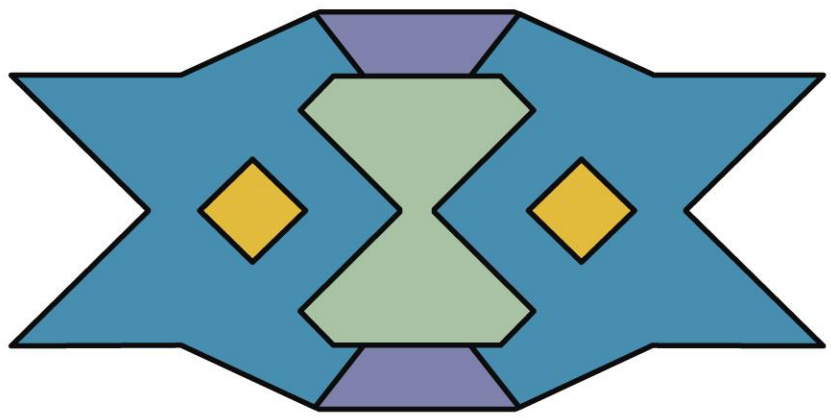

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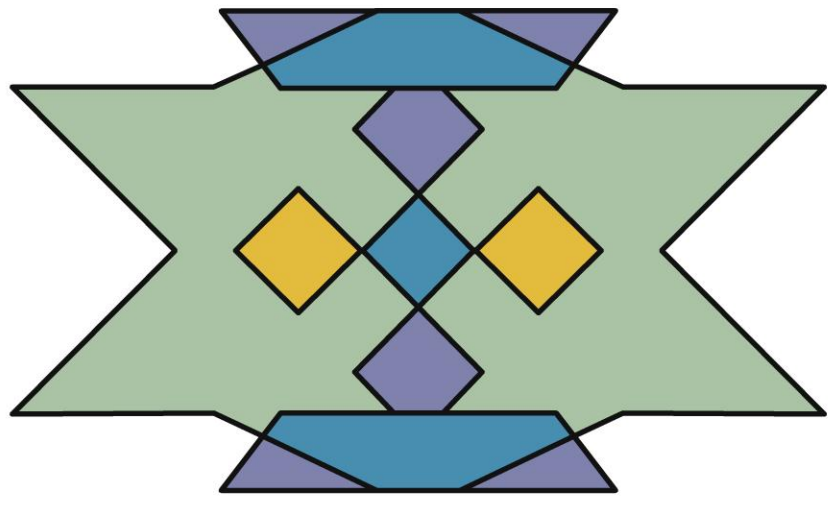

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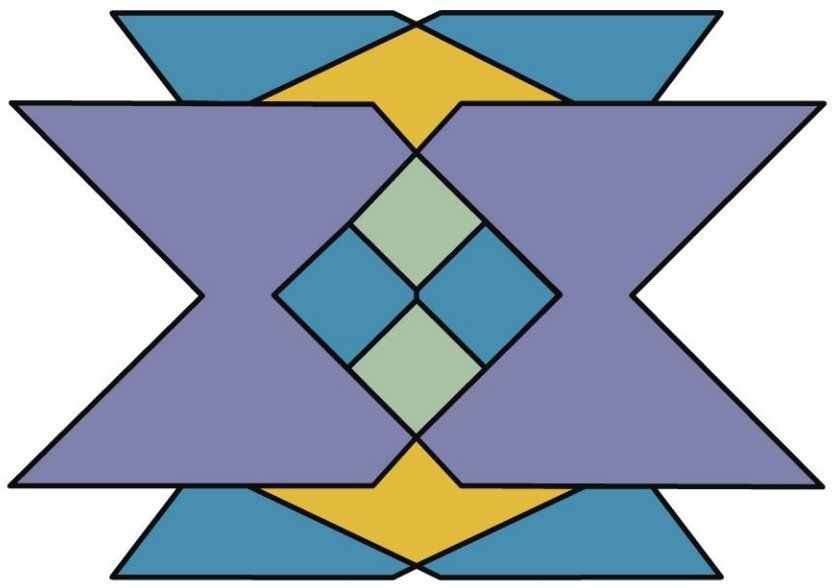

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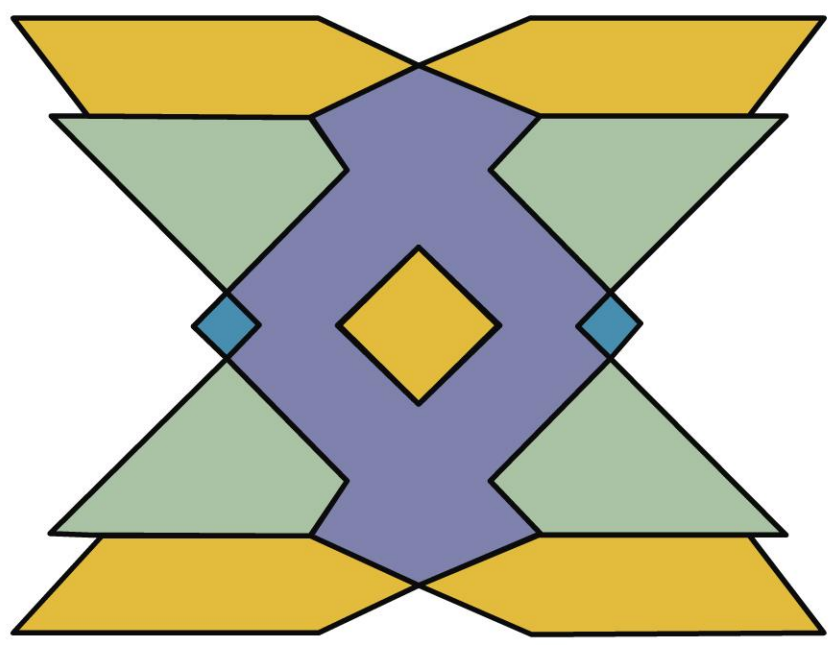

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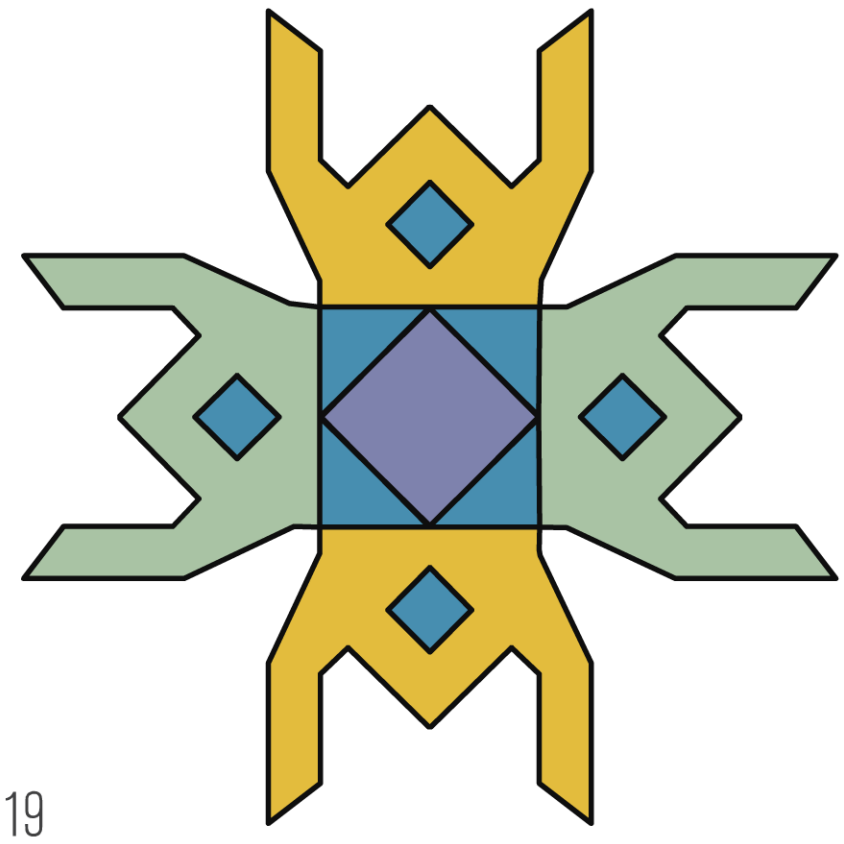
Eagle Eyes



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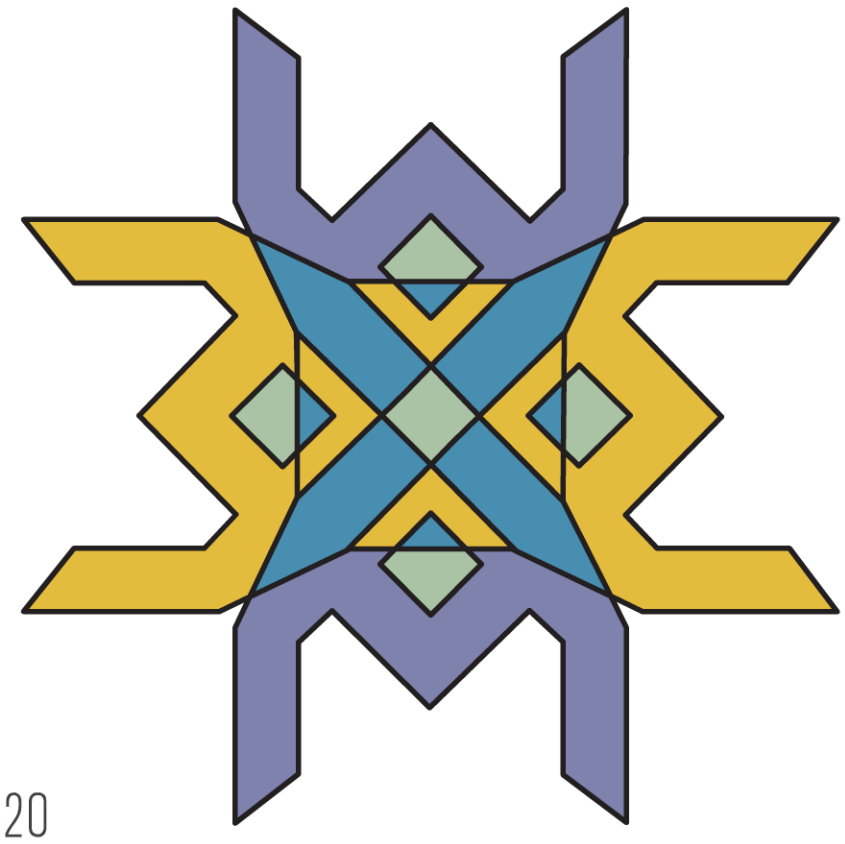

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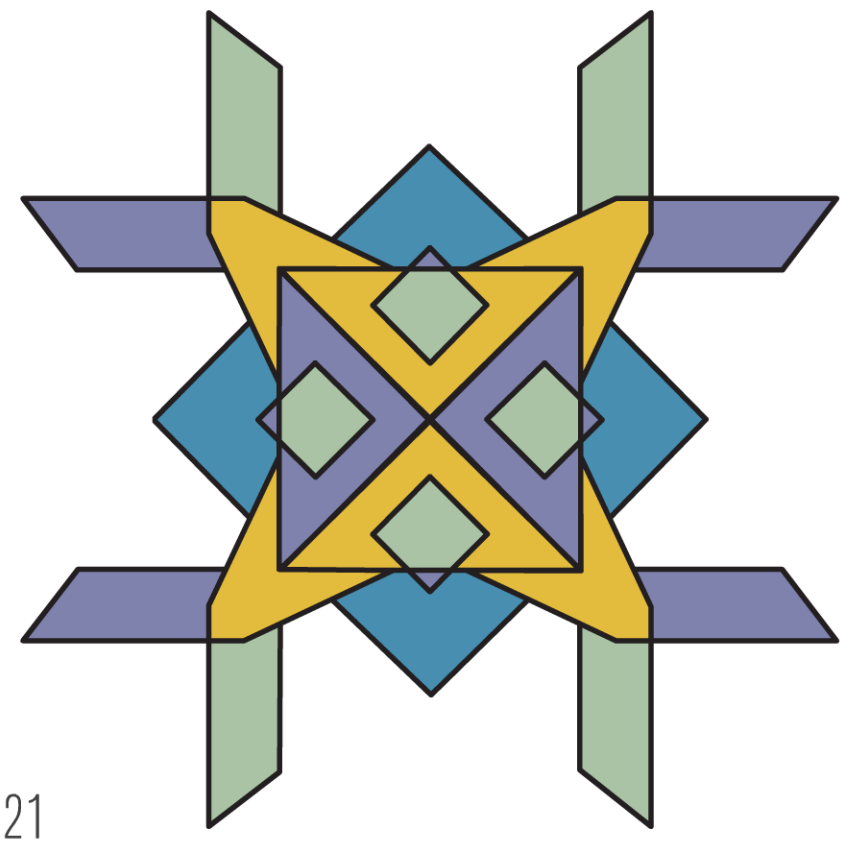

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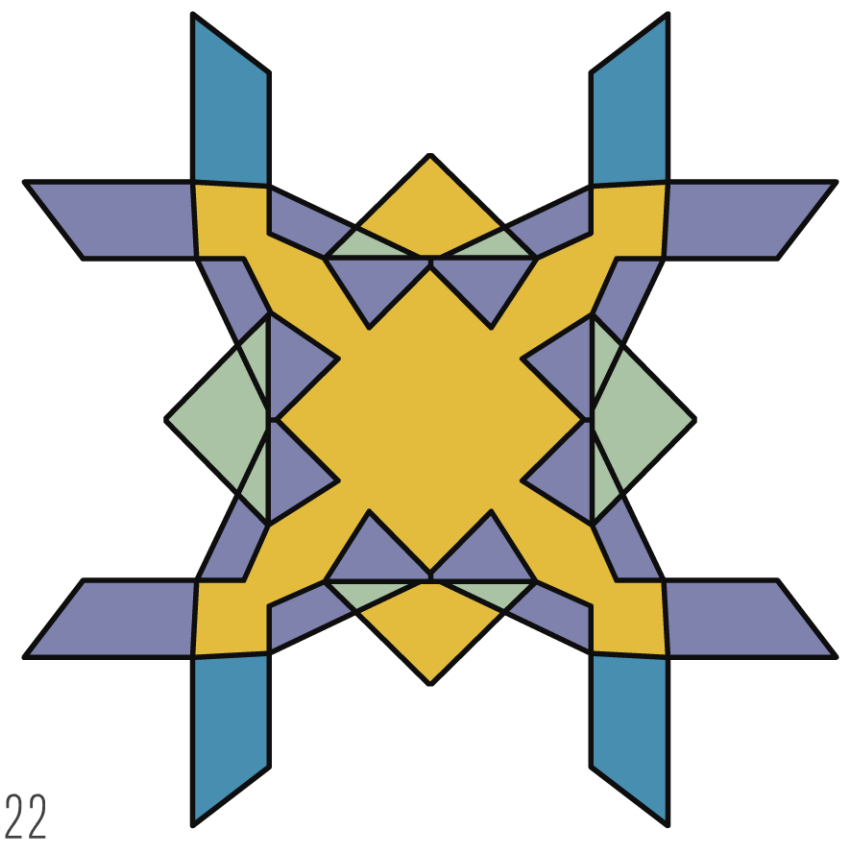

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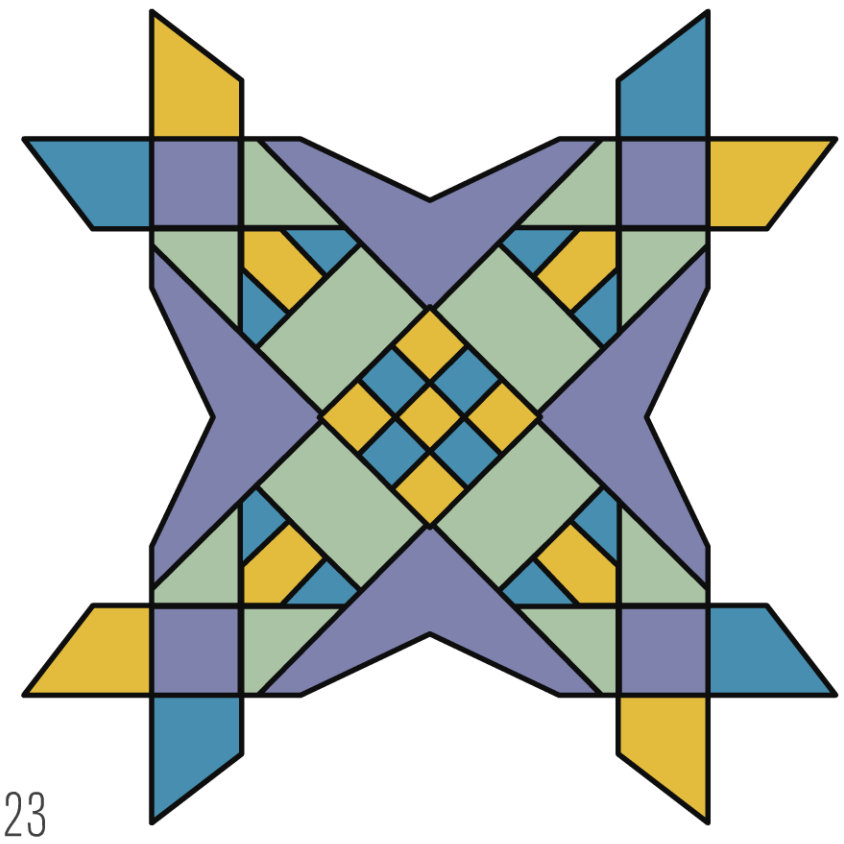

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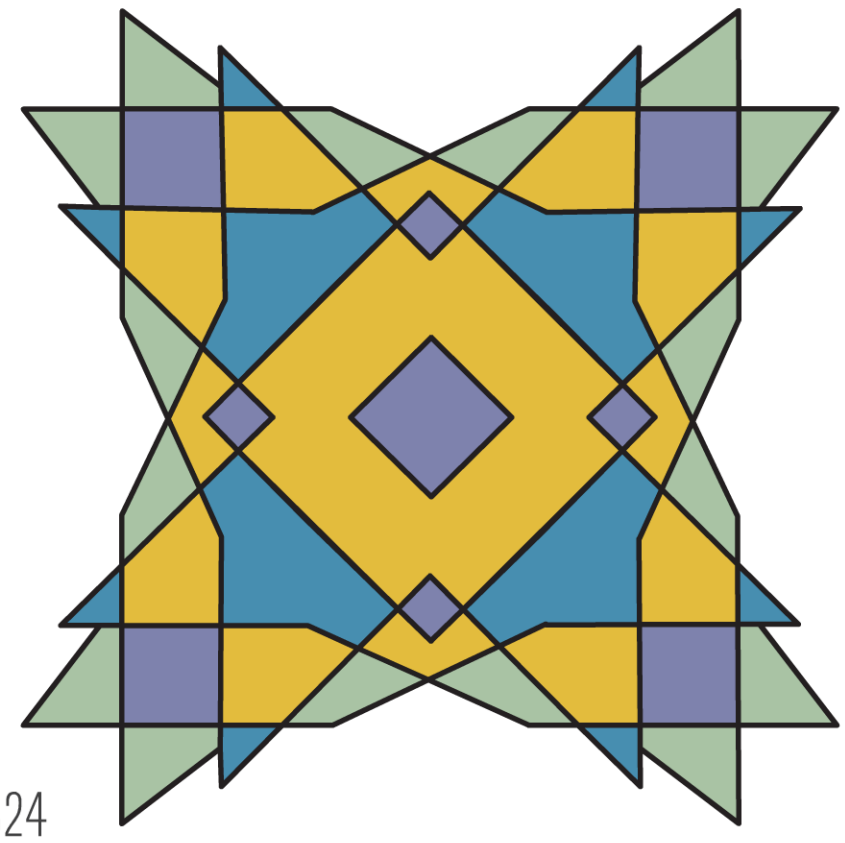

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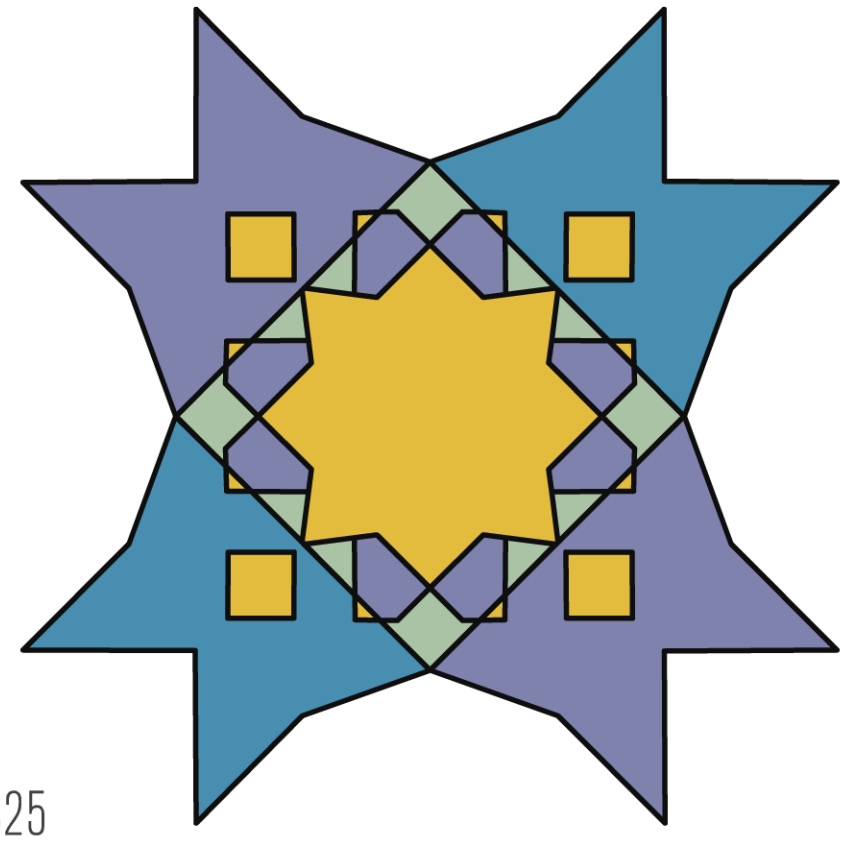

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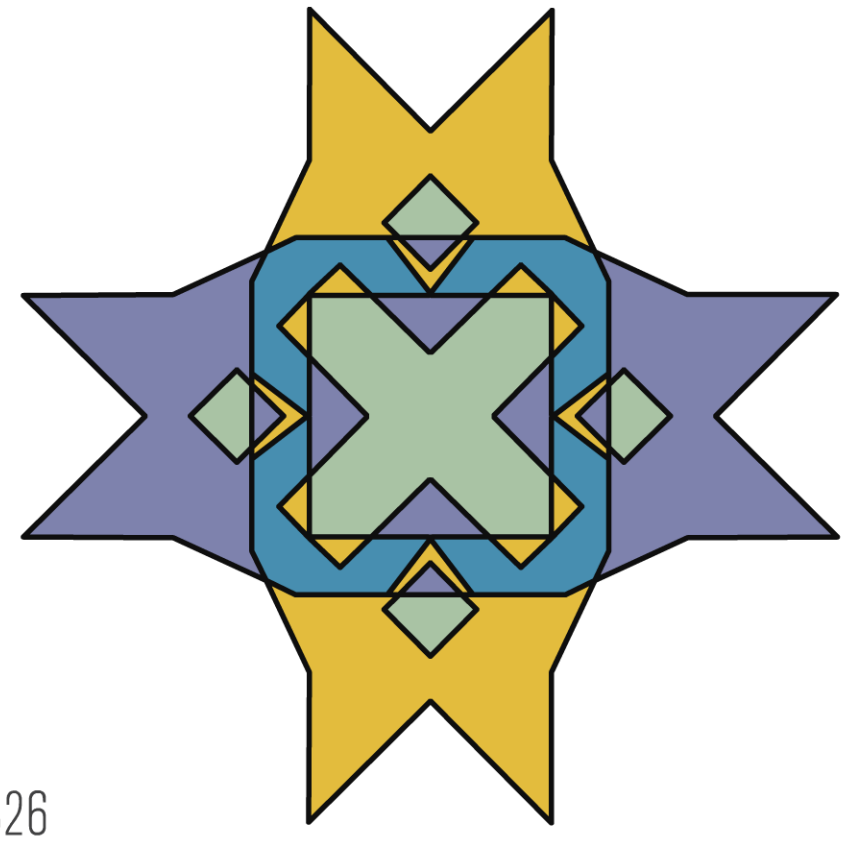

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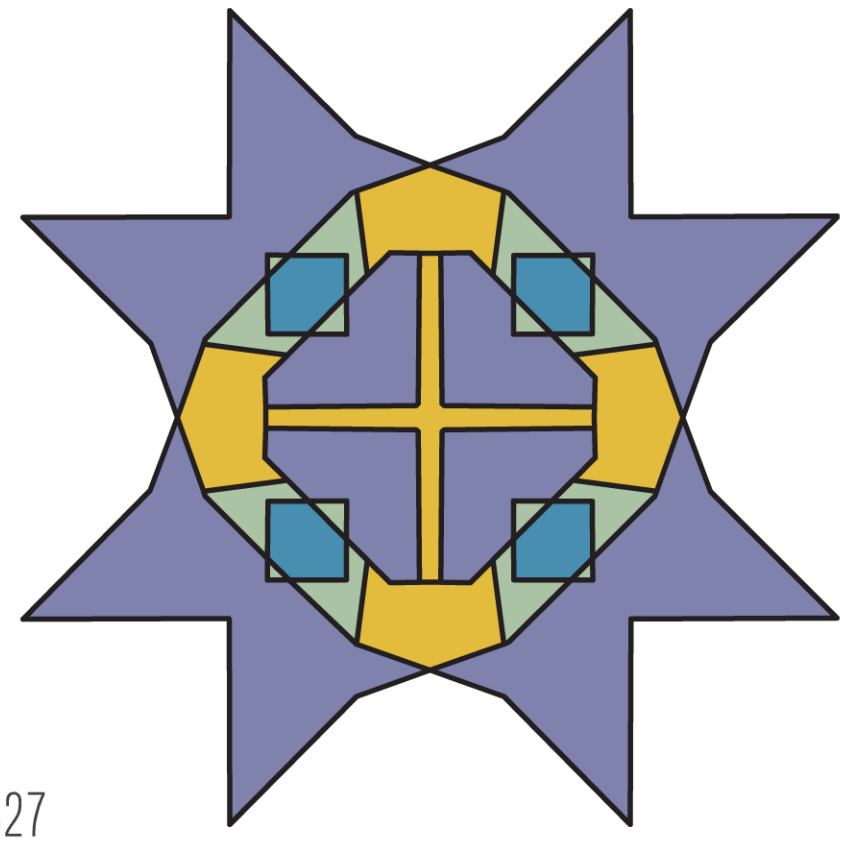

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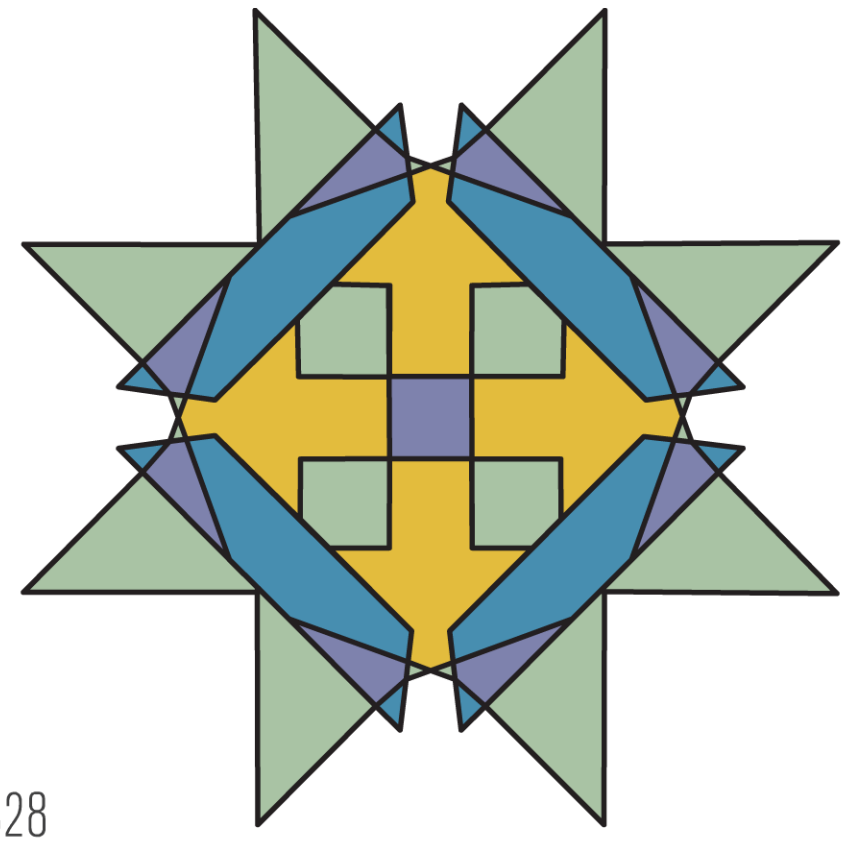

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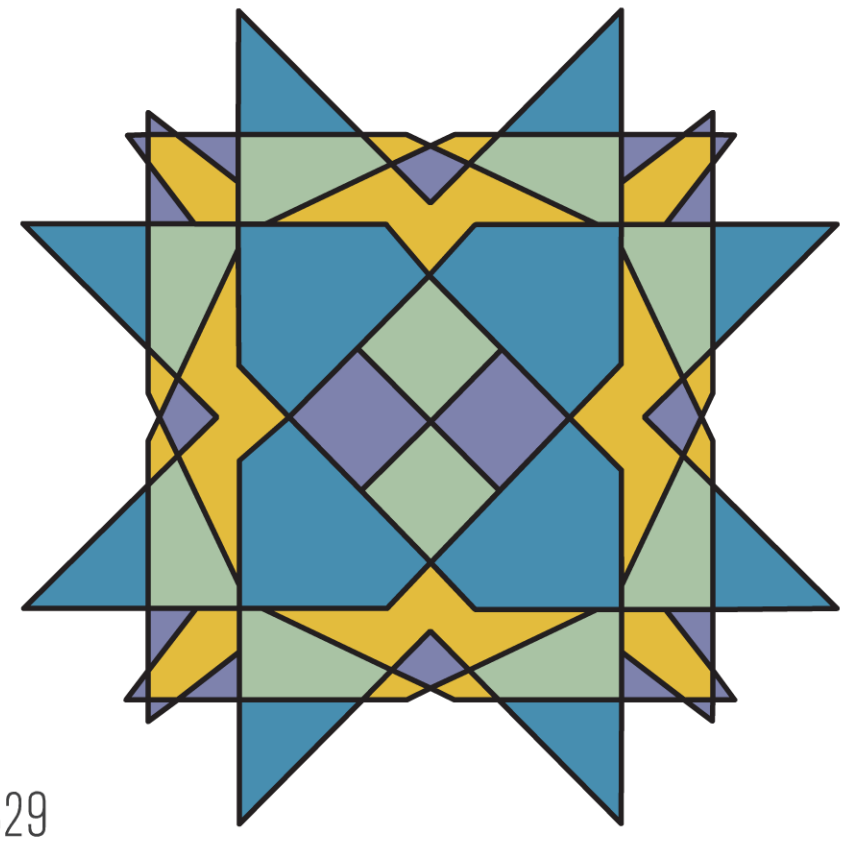

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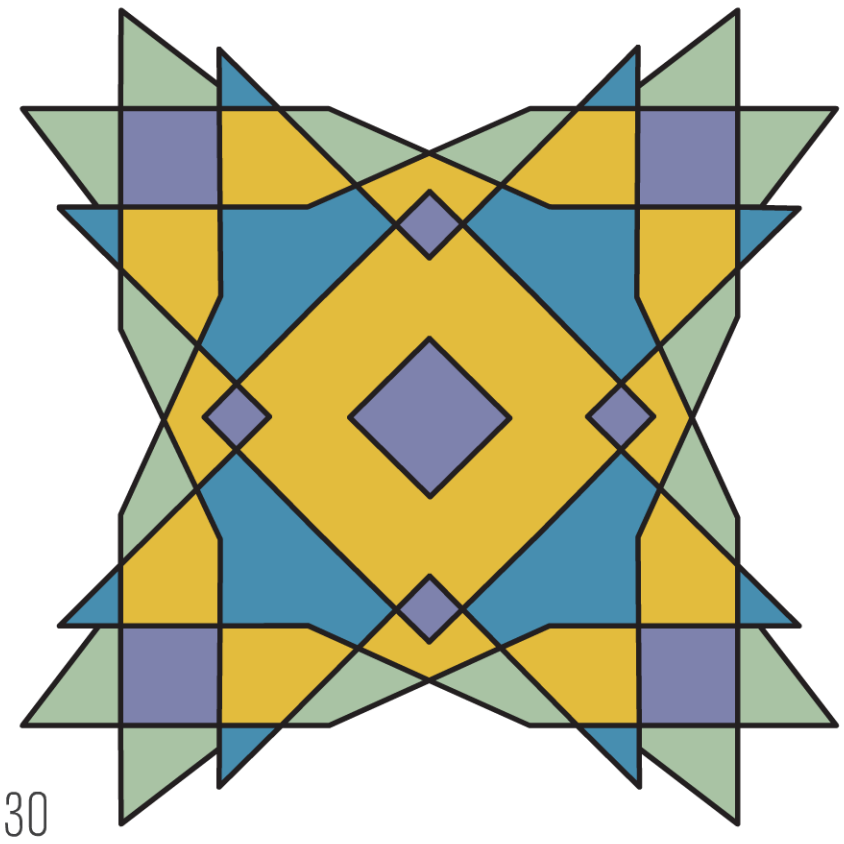

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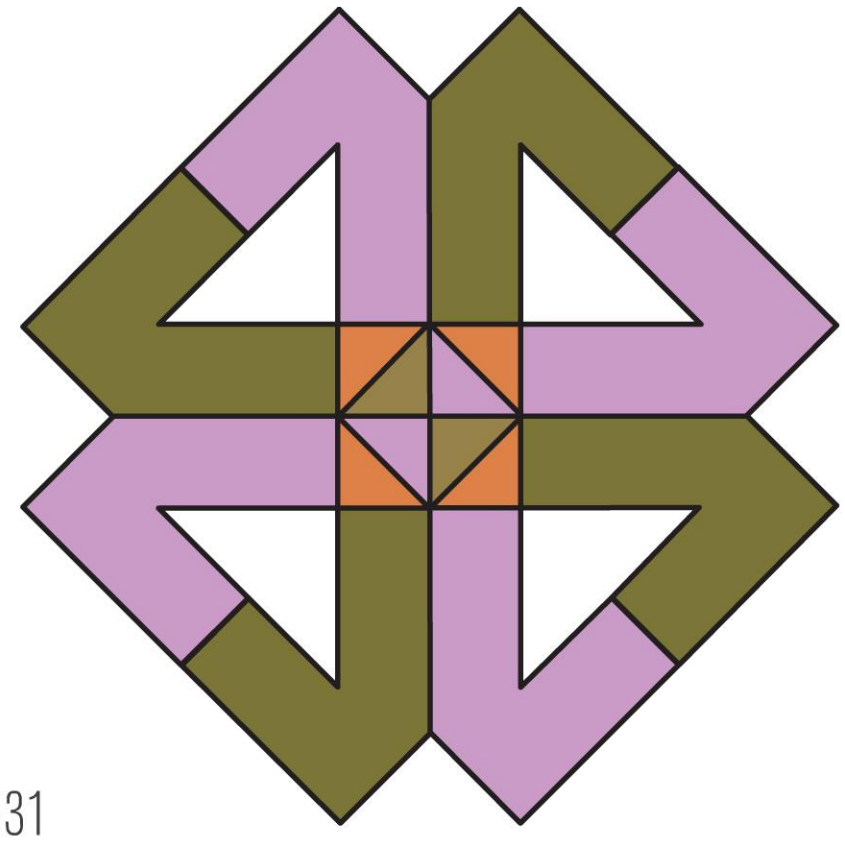

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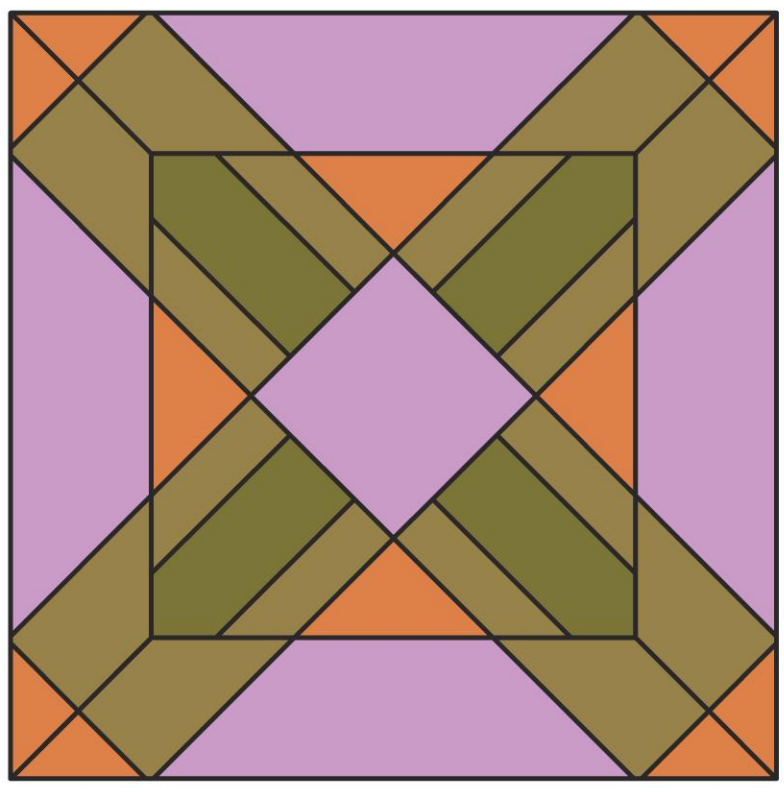

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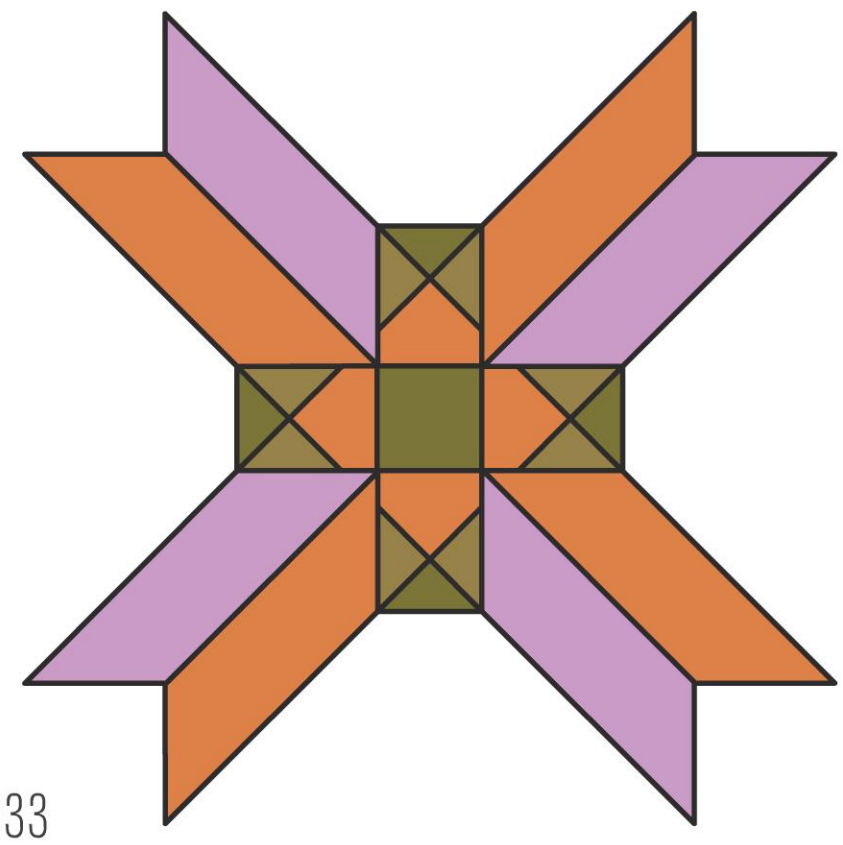

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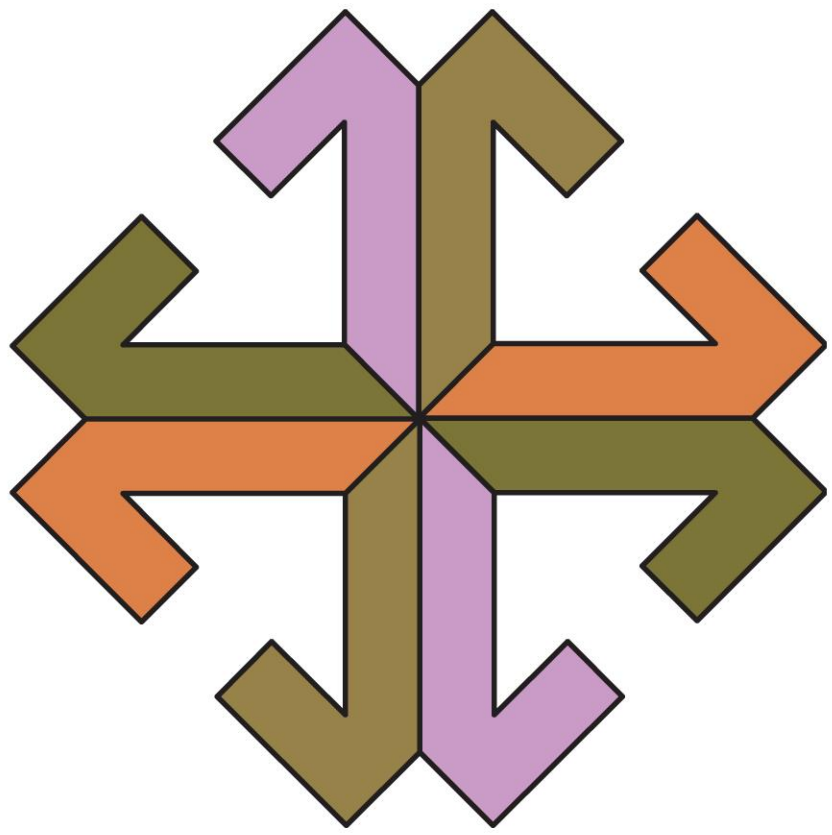

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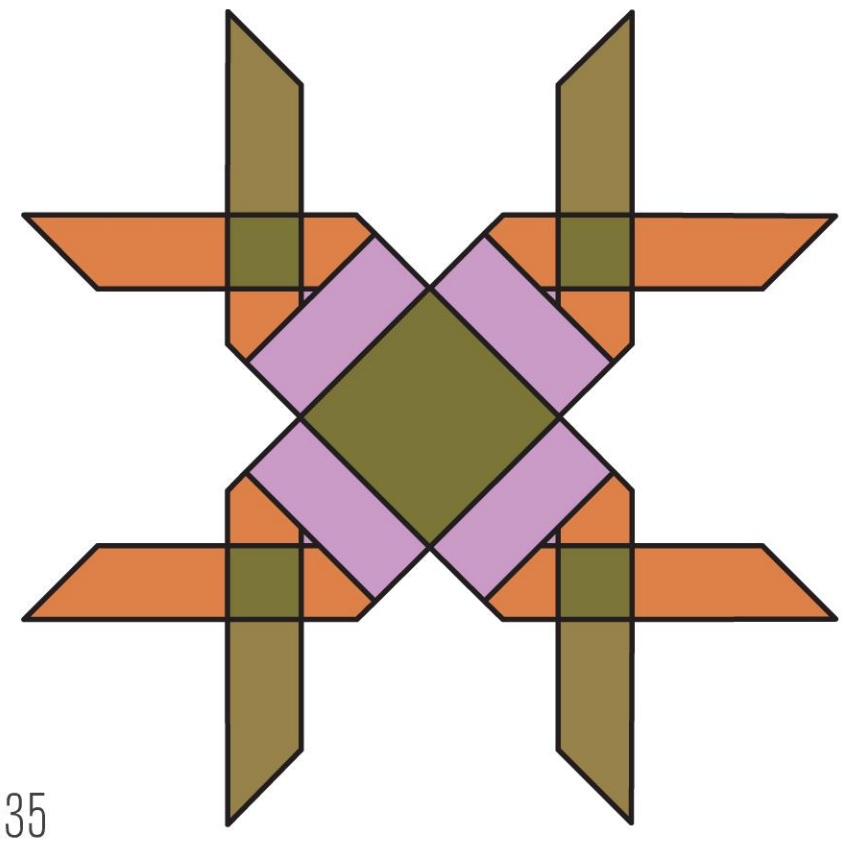

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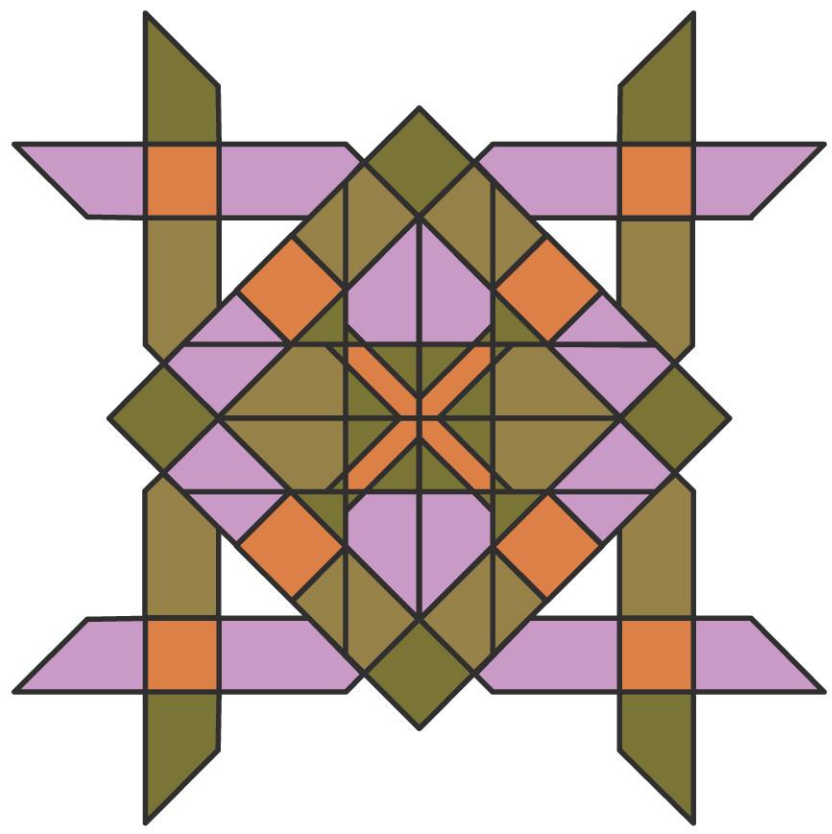

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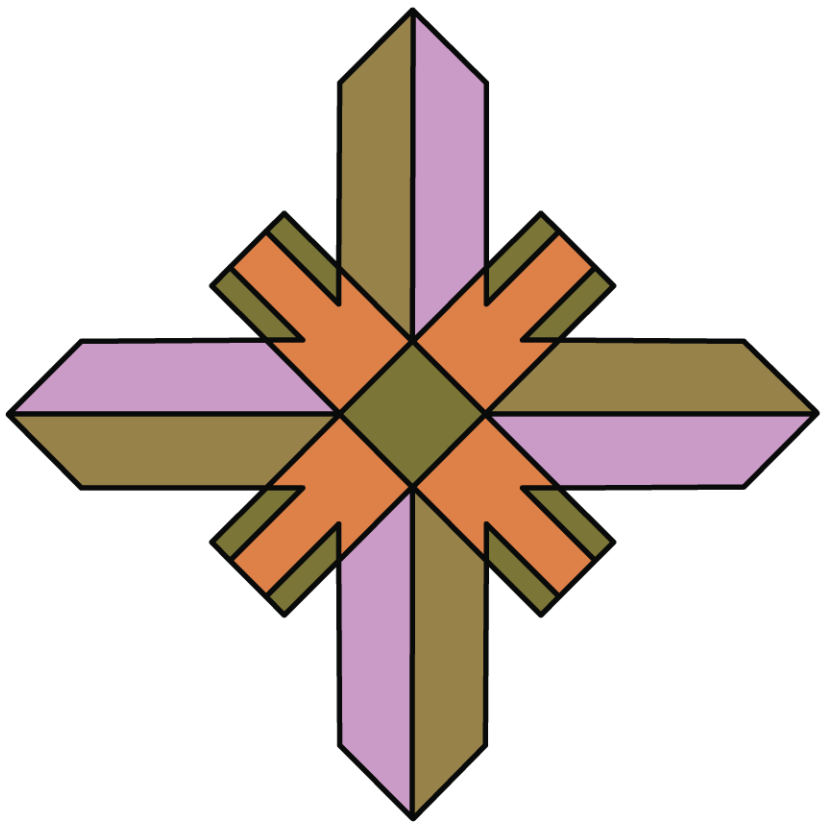

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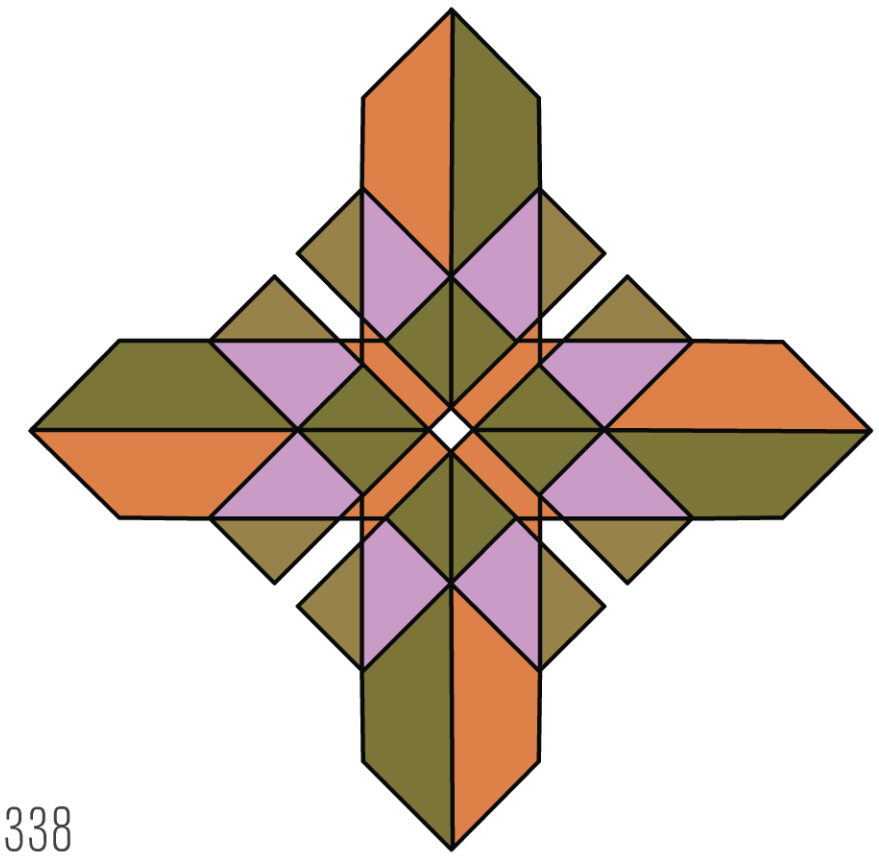

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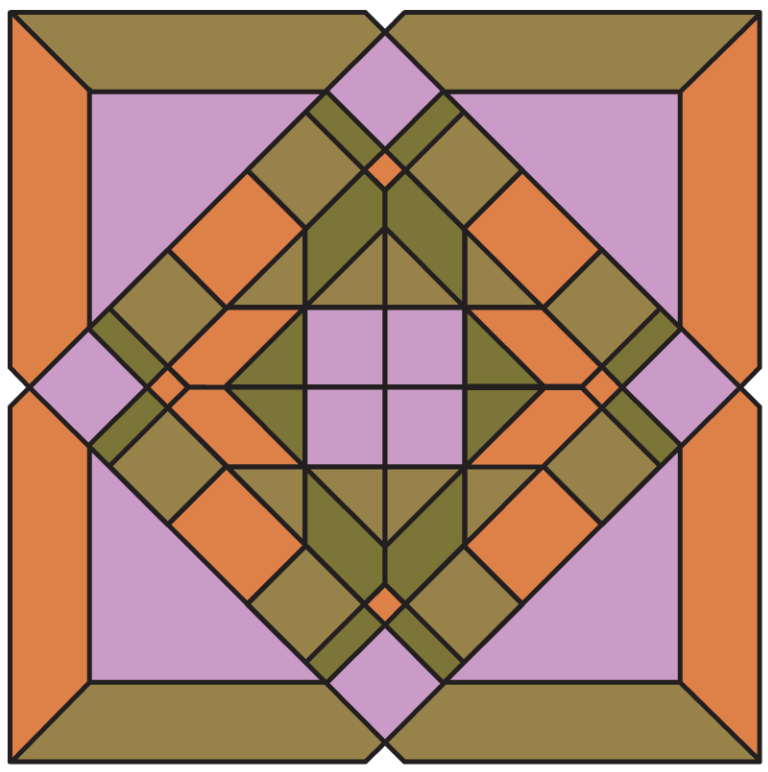

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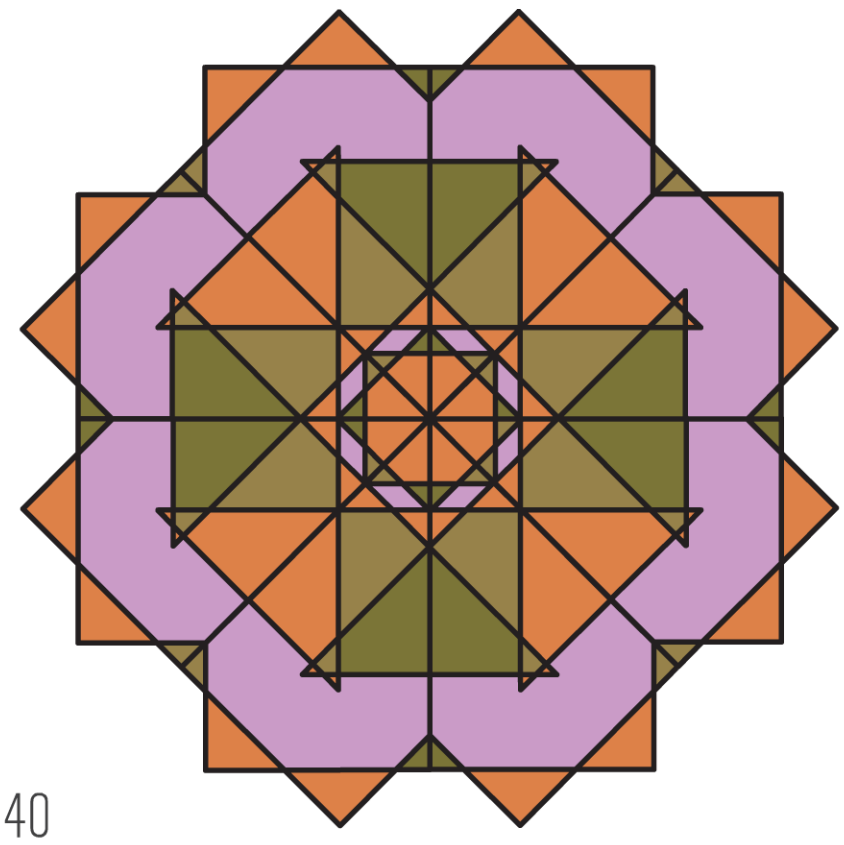

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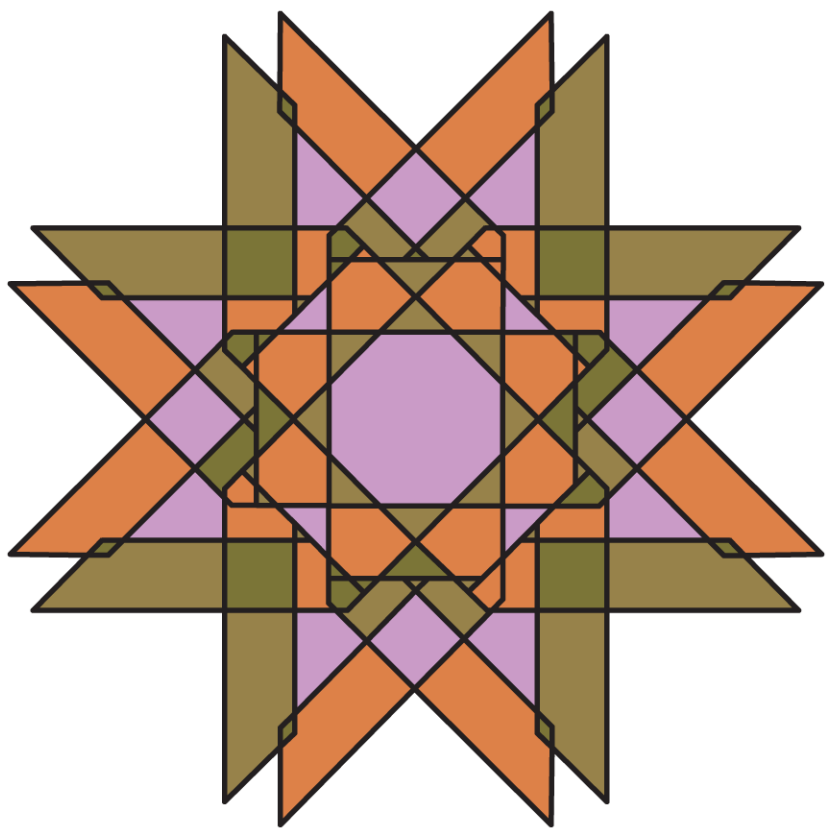

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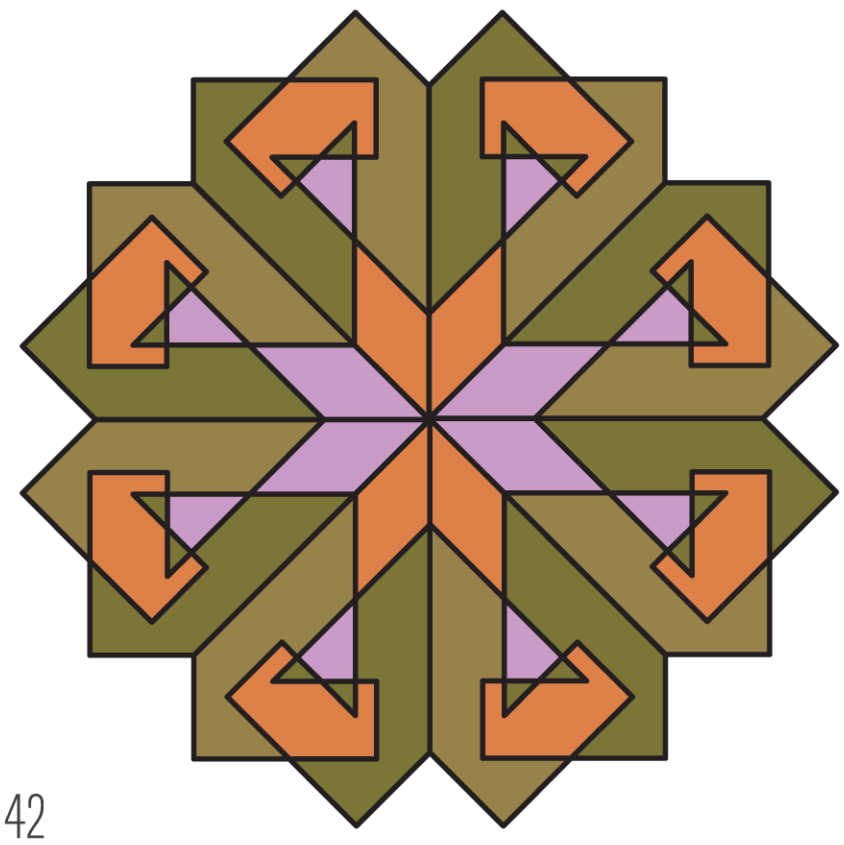

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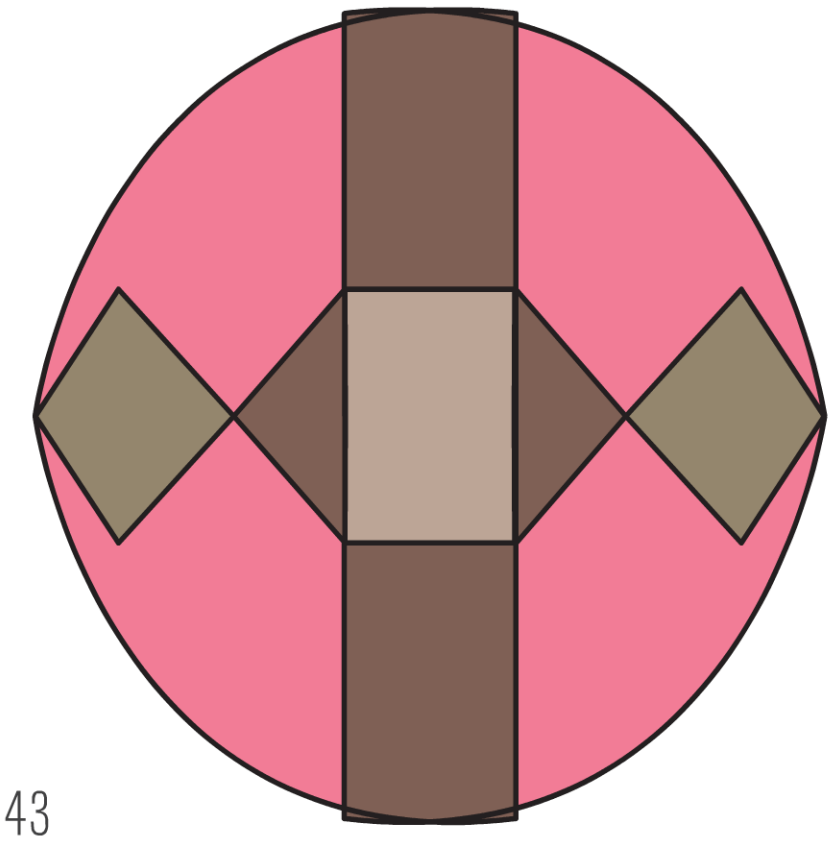

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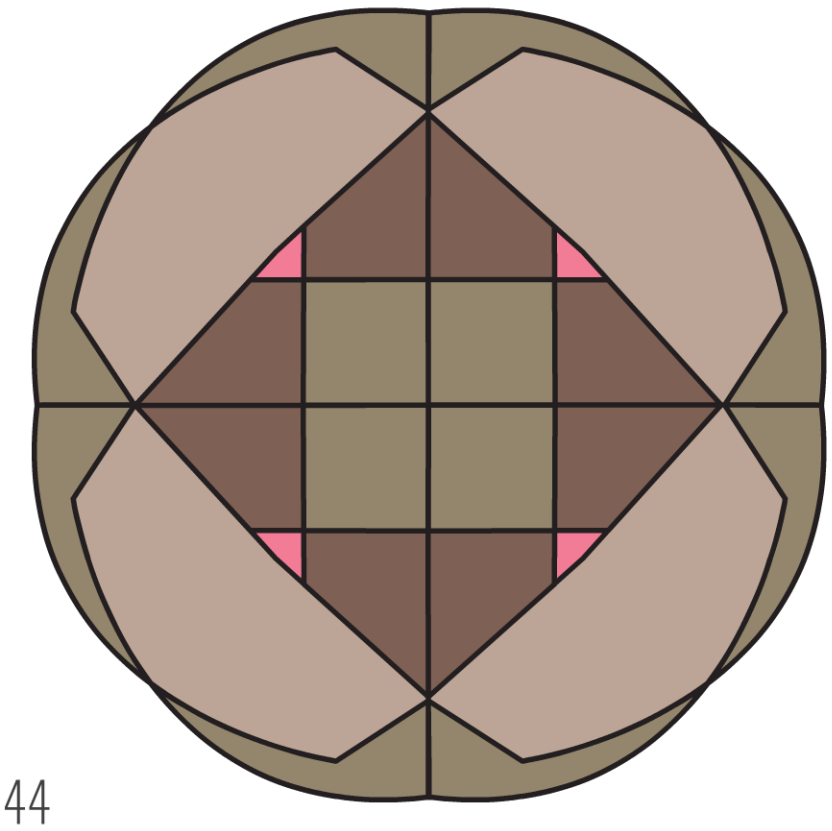

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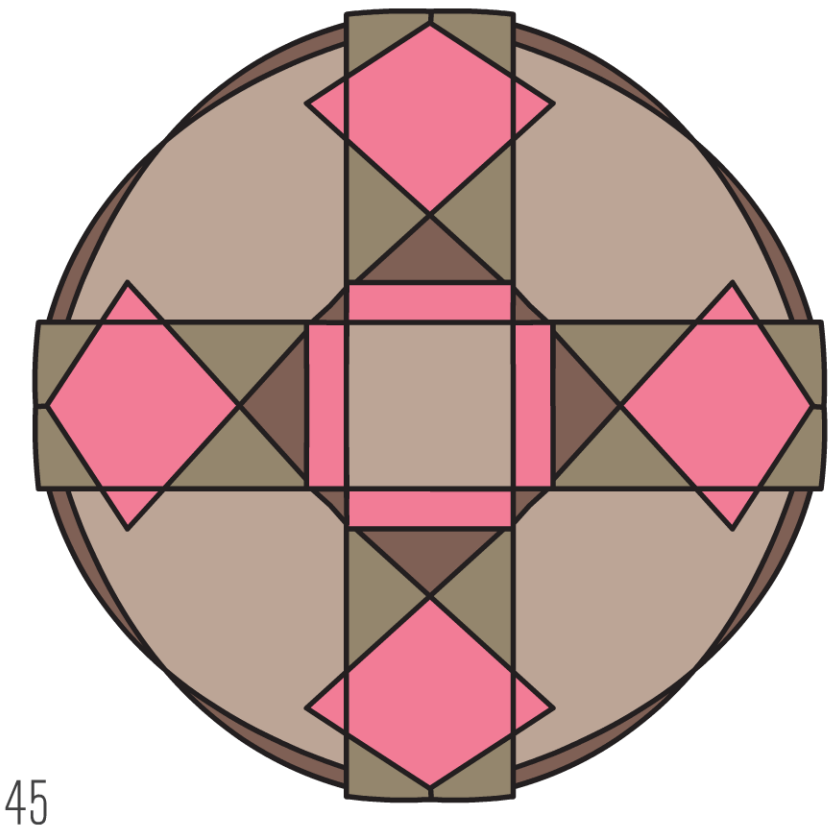

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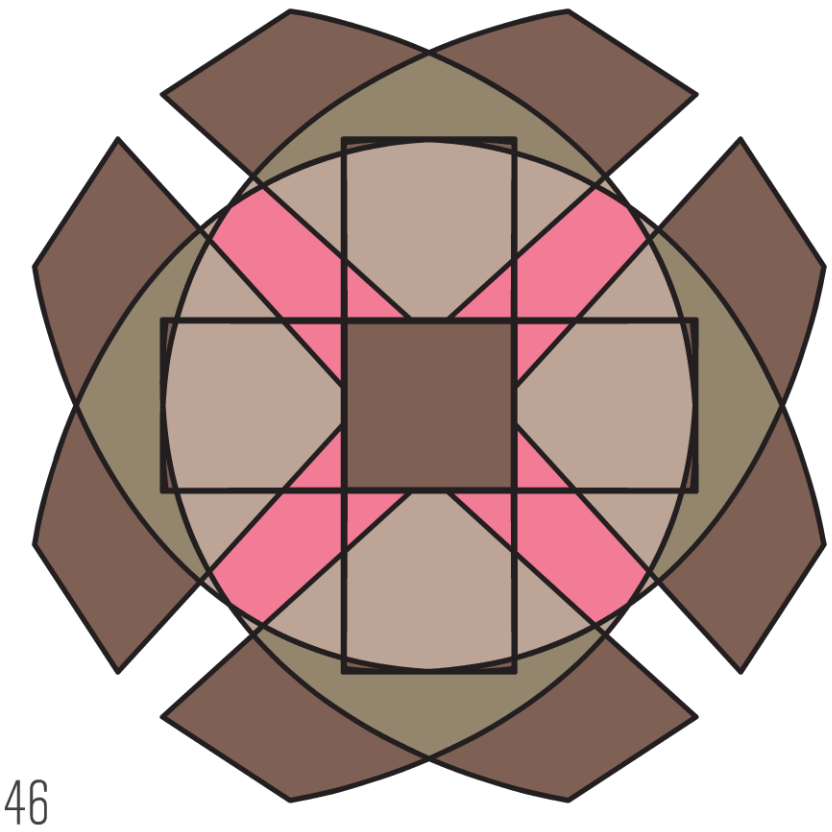

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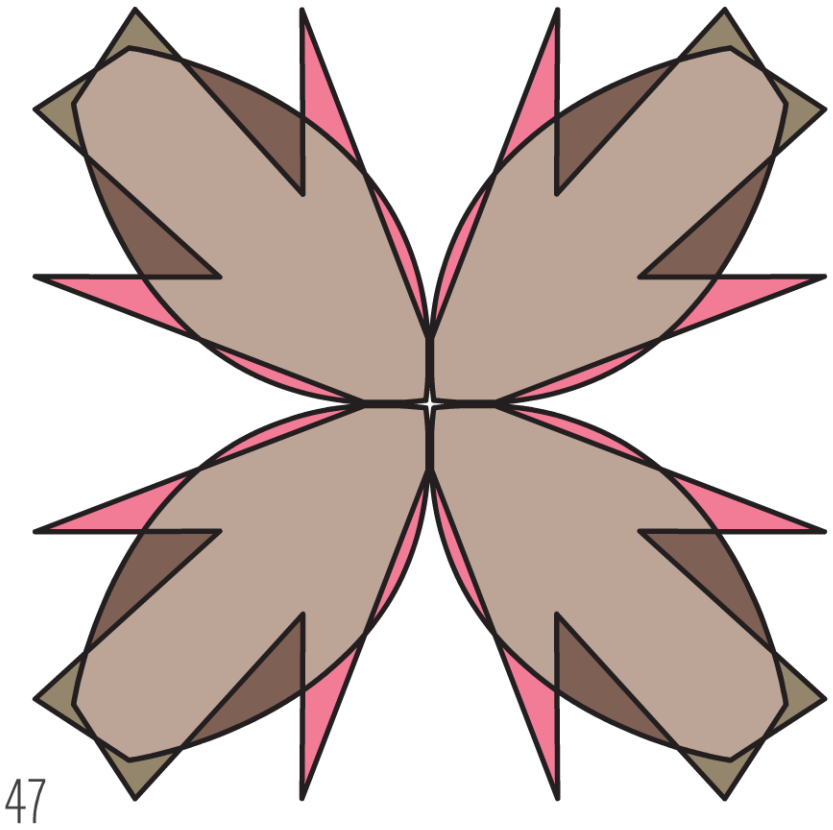

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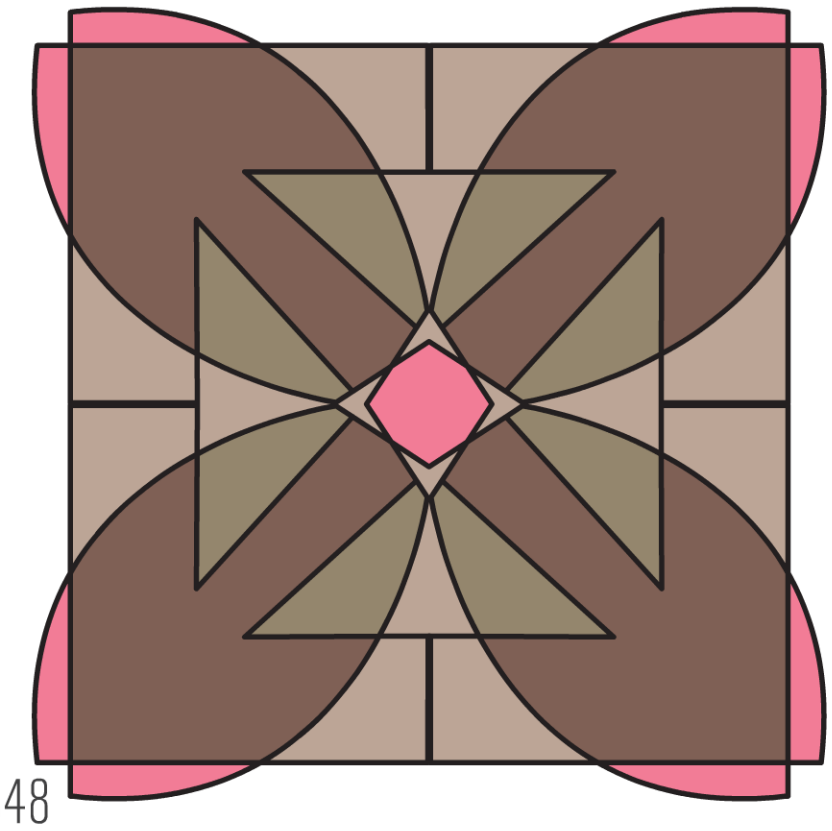

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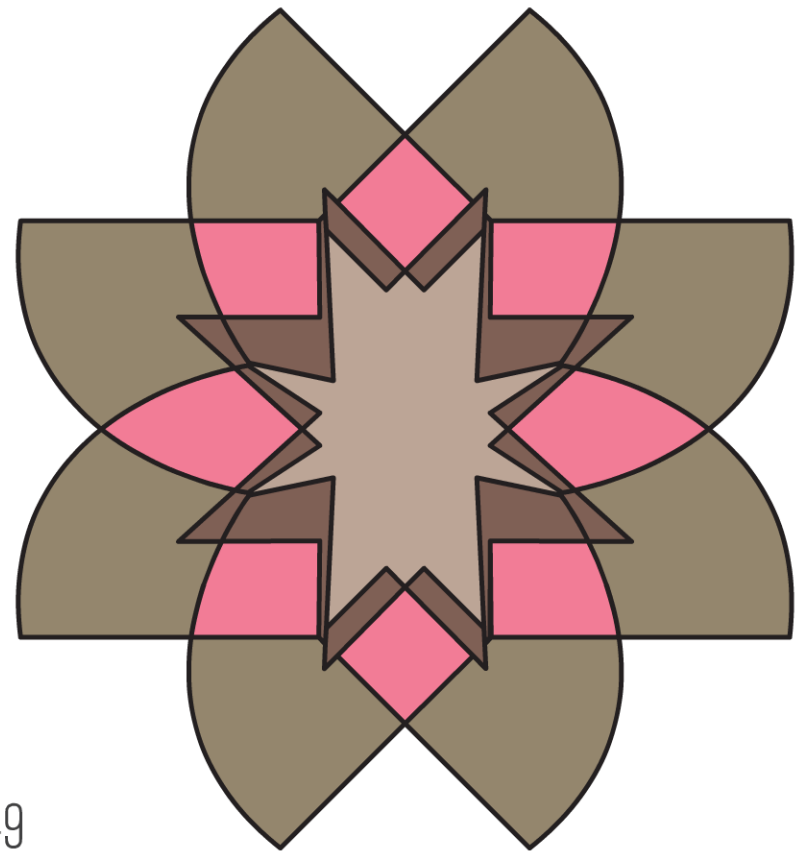

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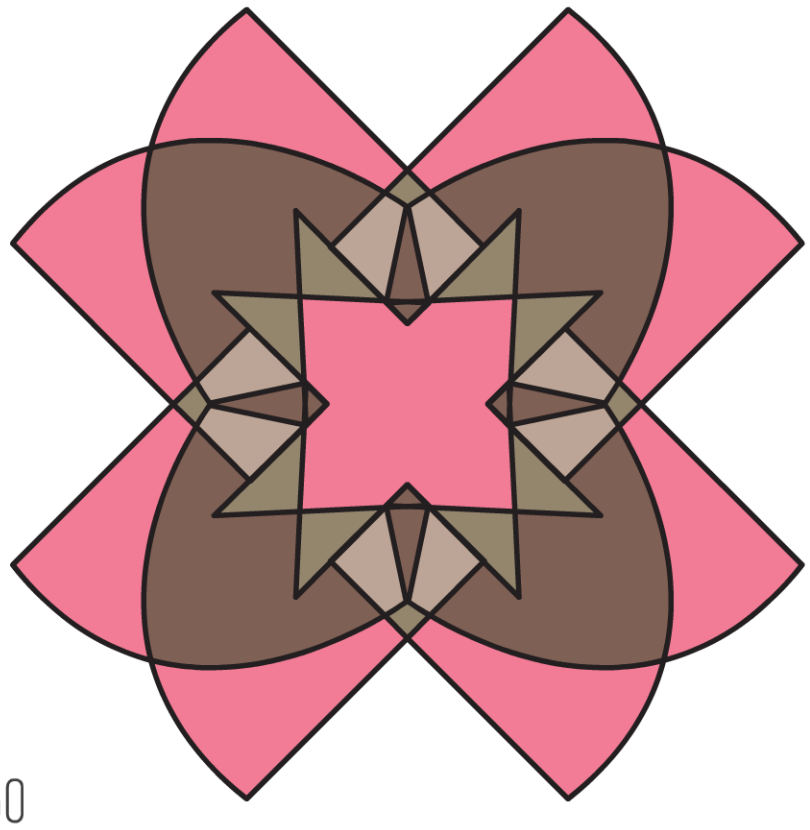

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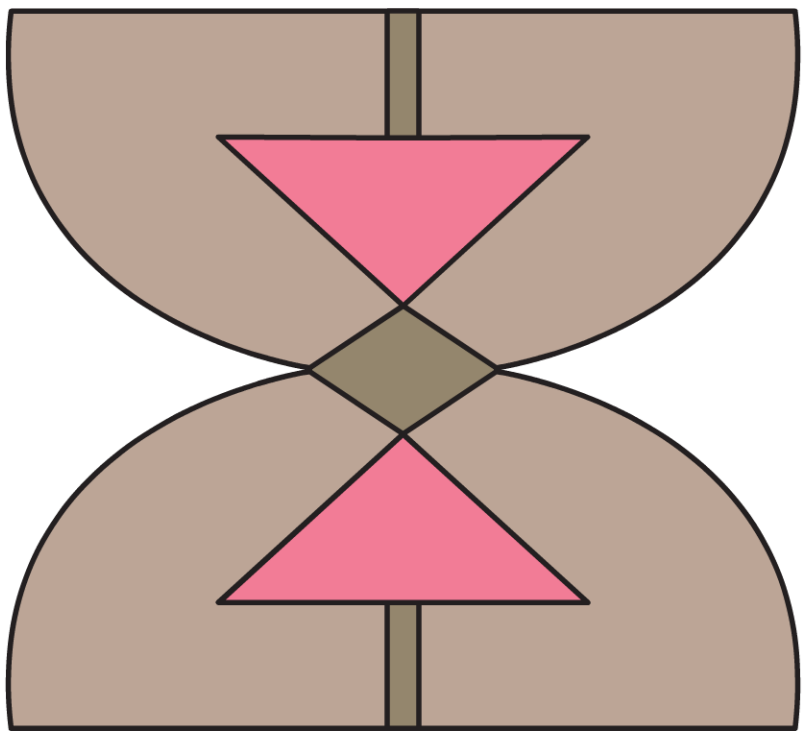

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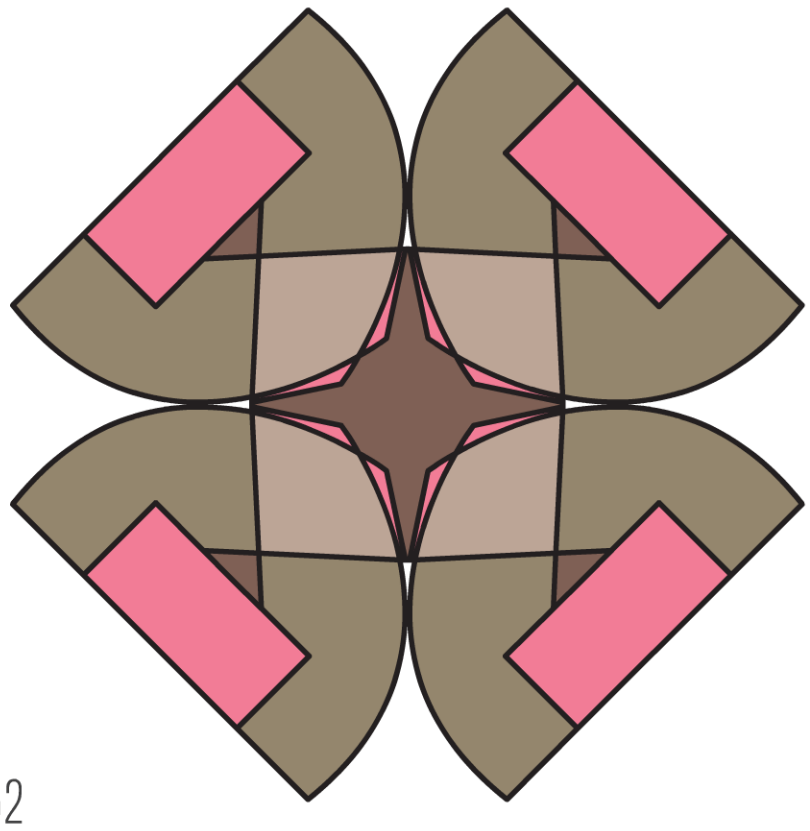

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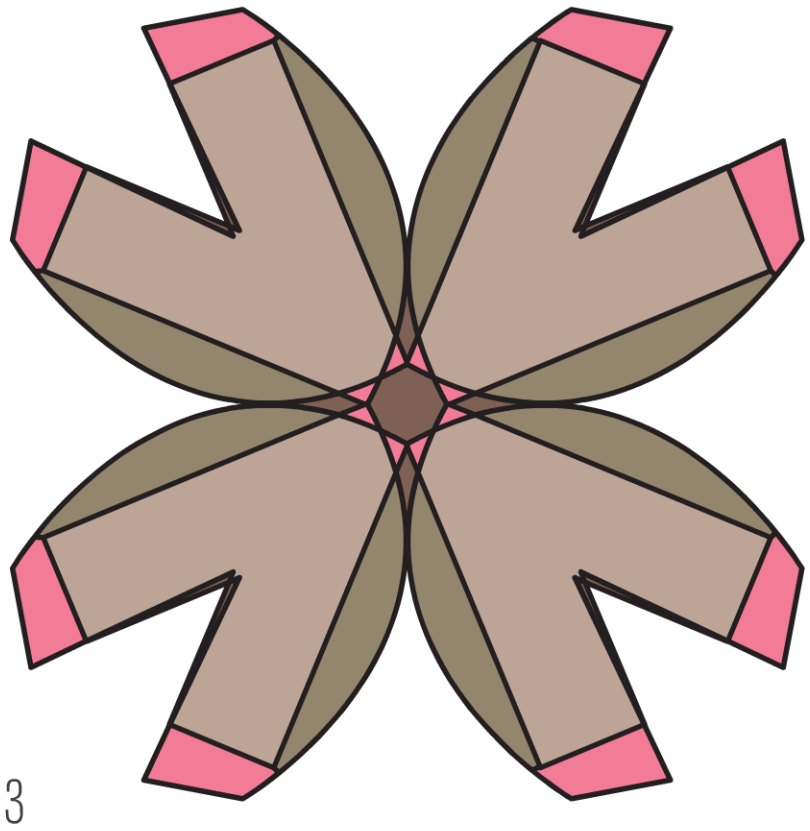

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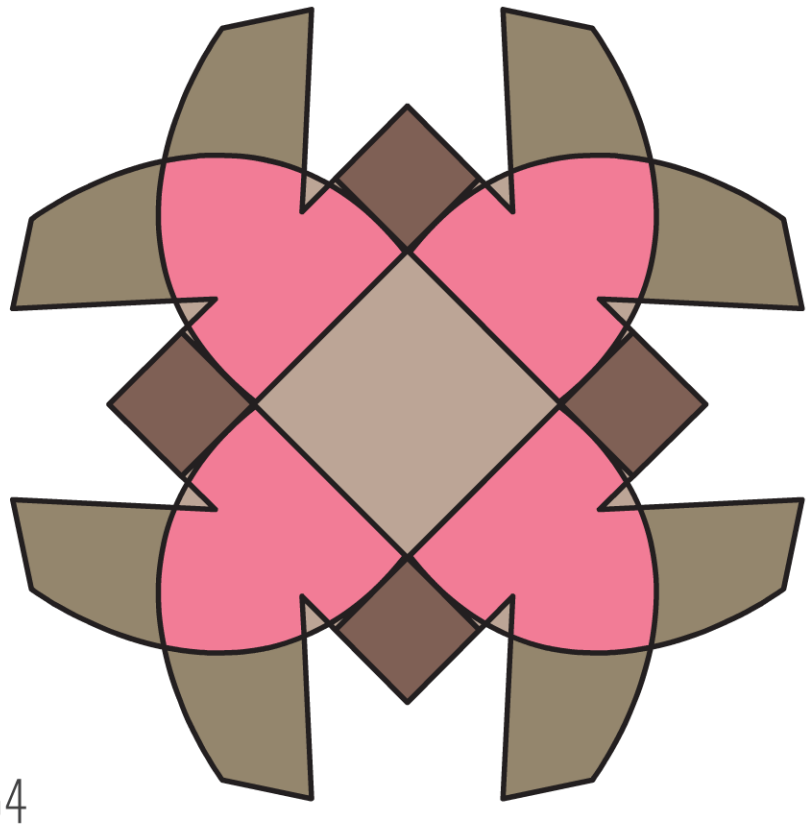

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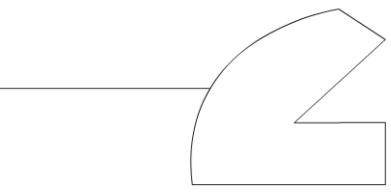

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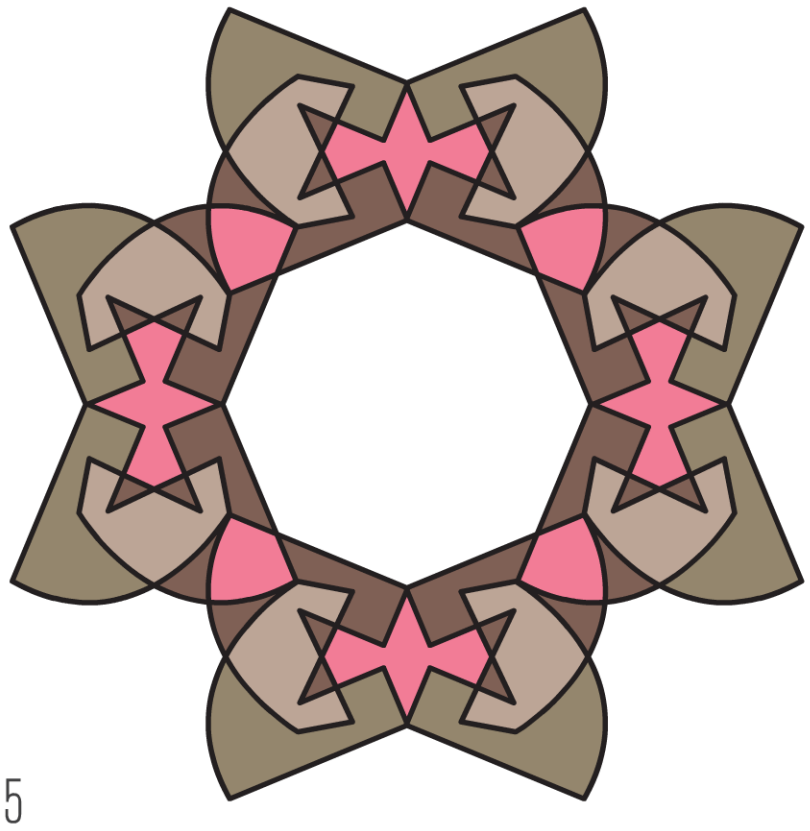

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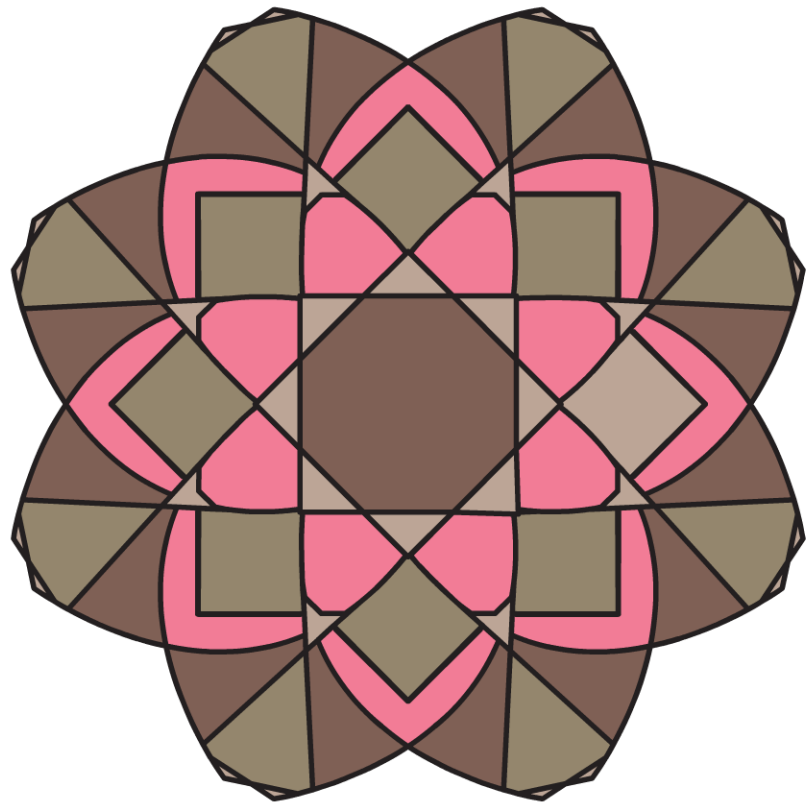

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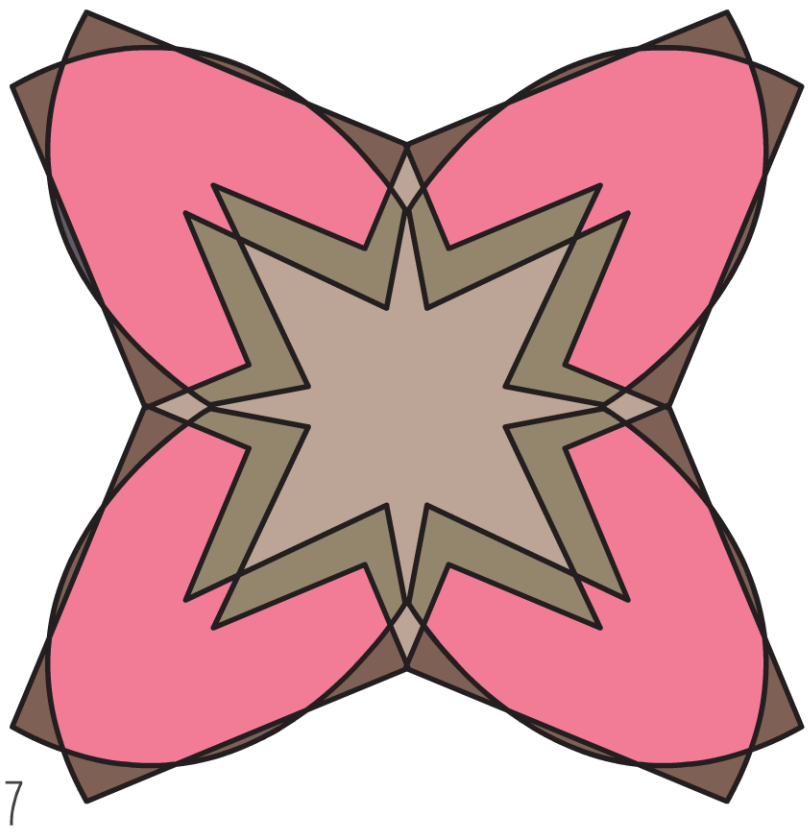

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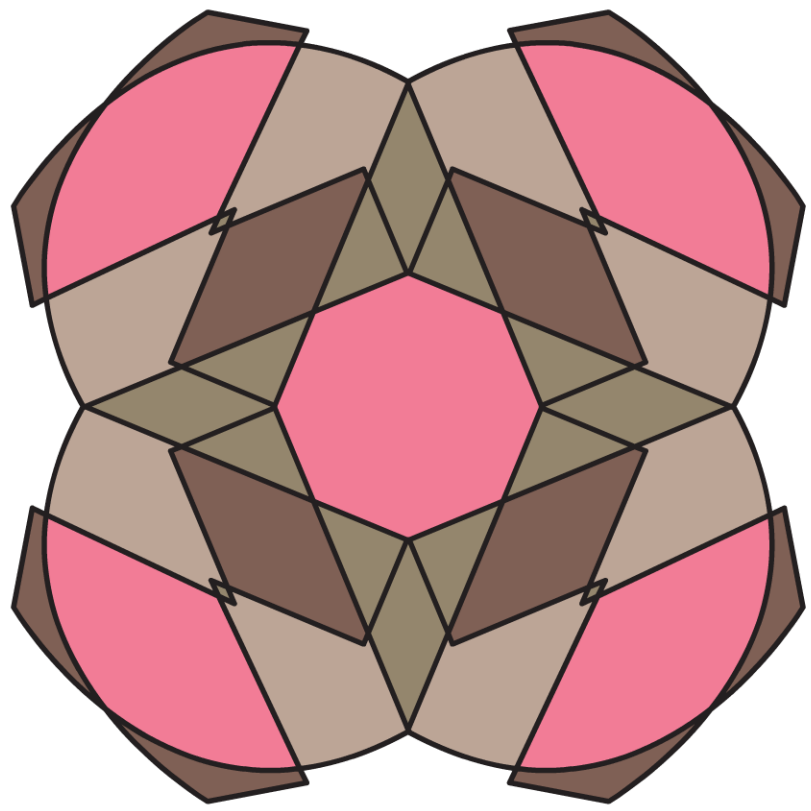

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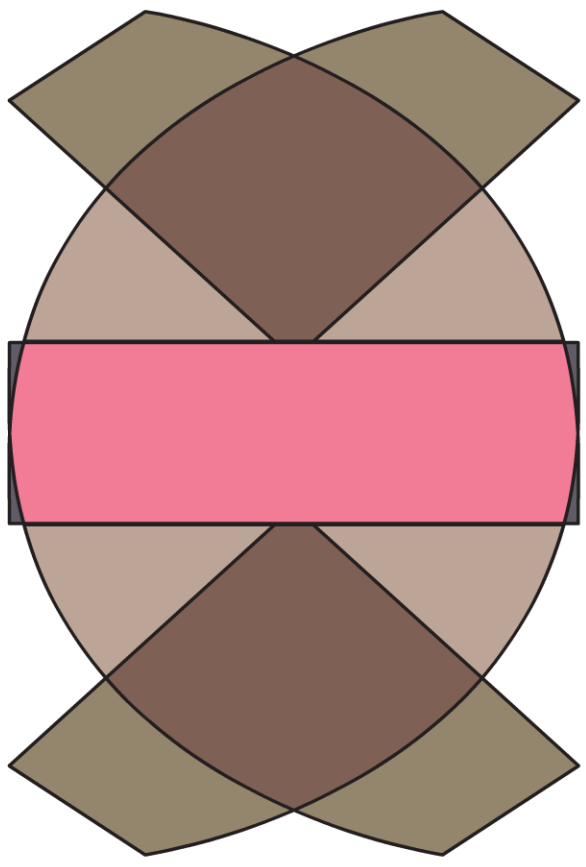

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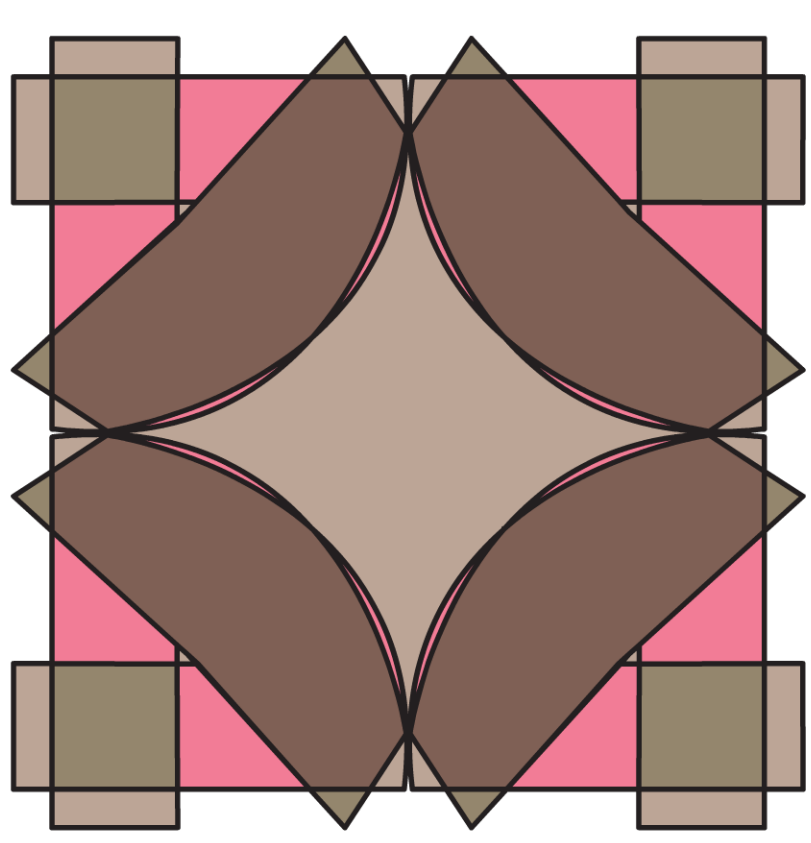

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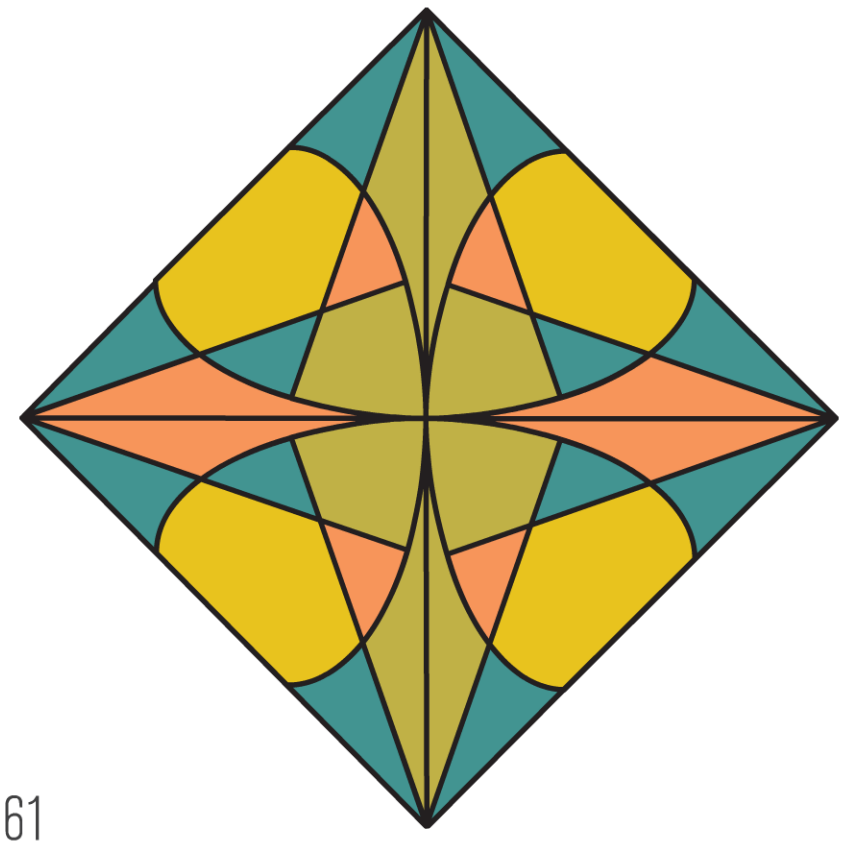
Fans



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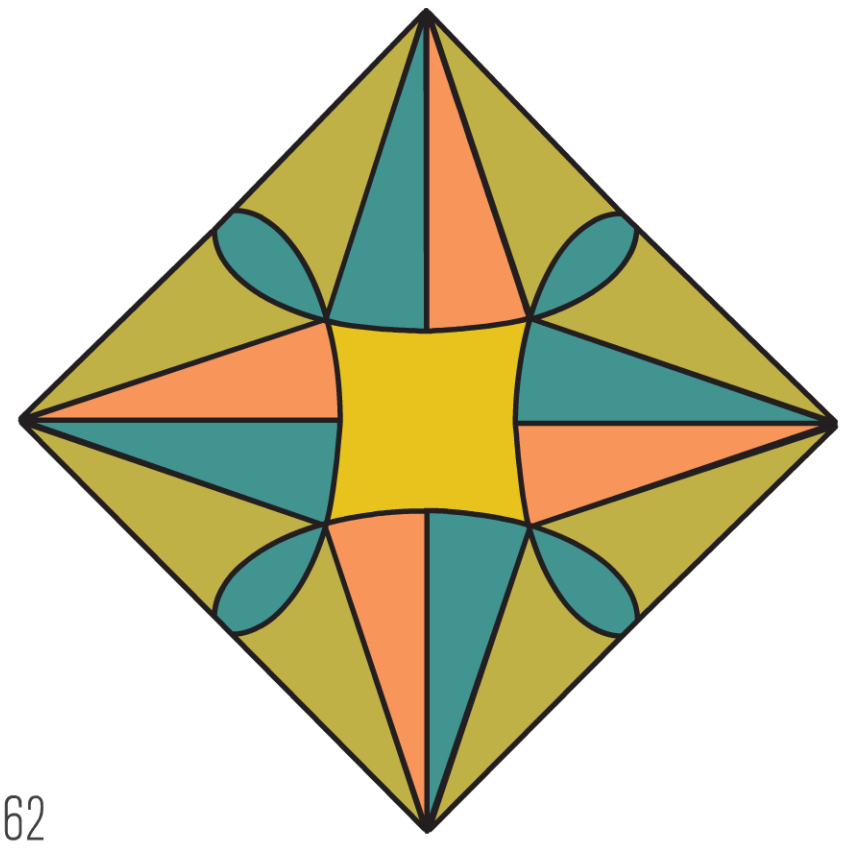

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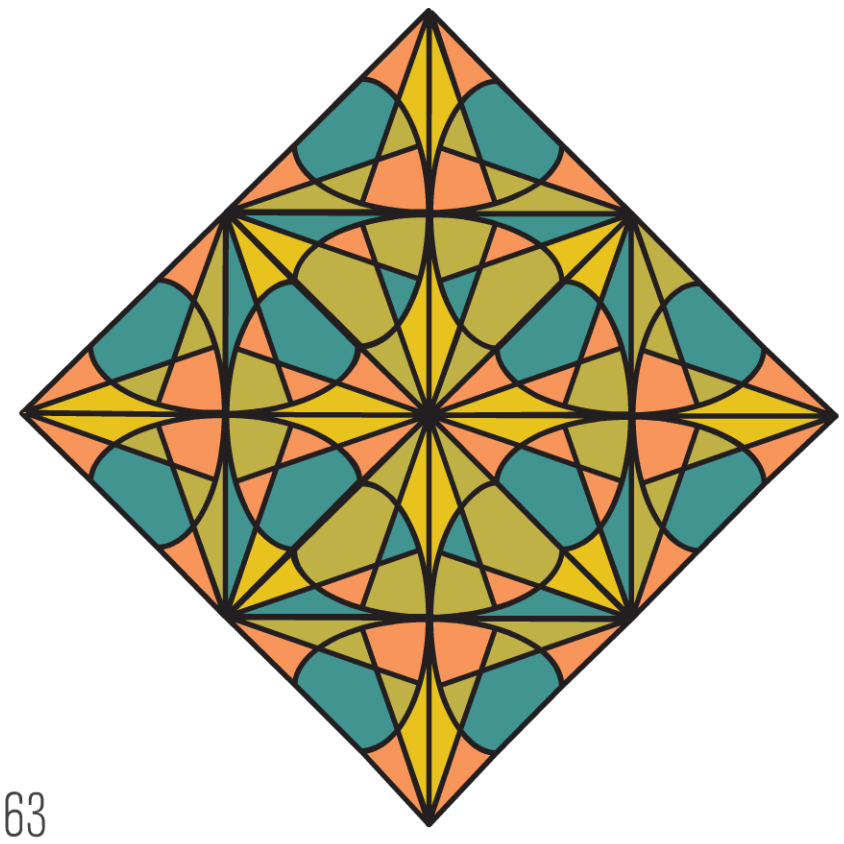

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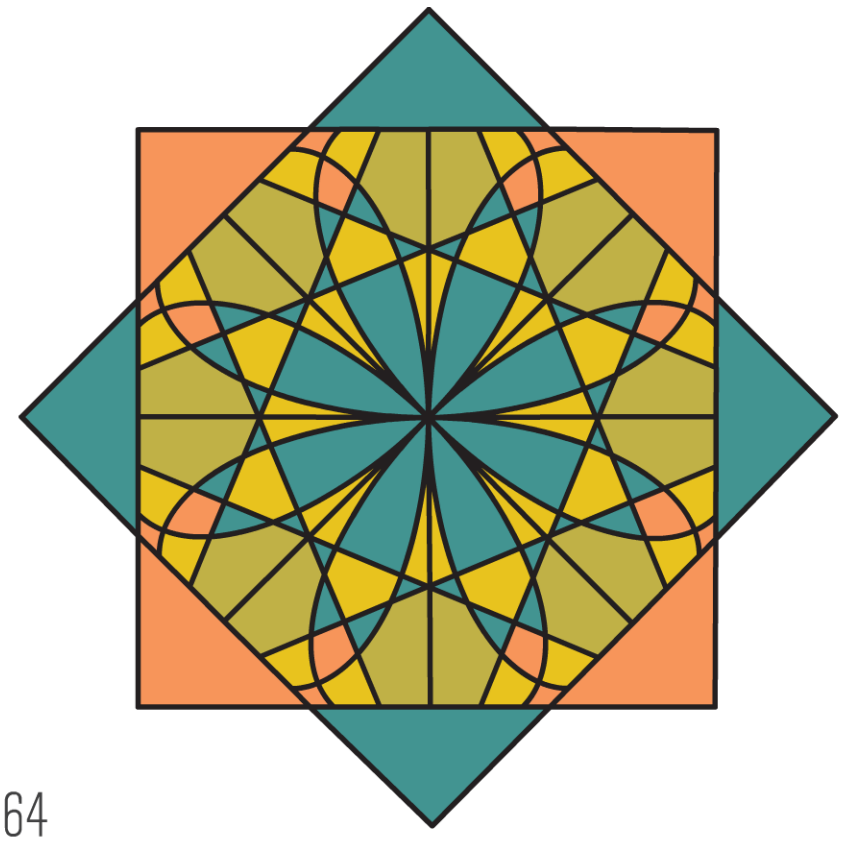

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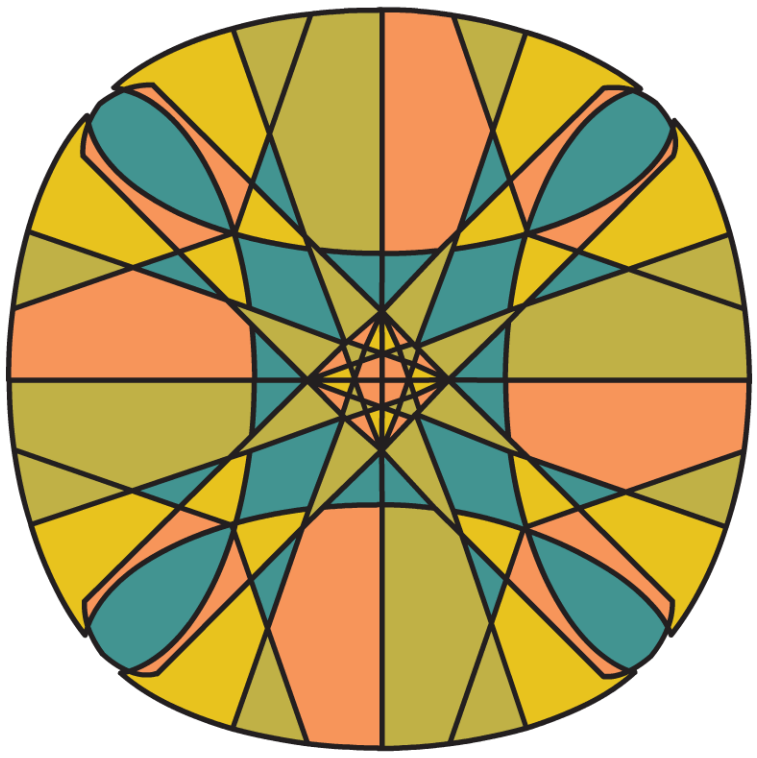

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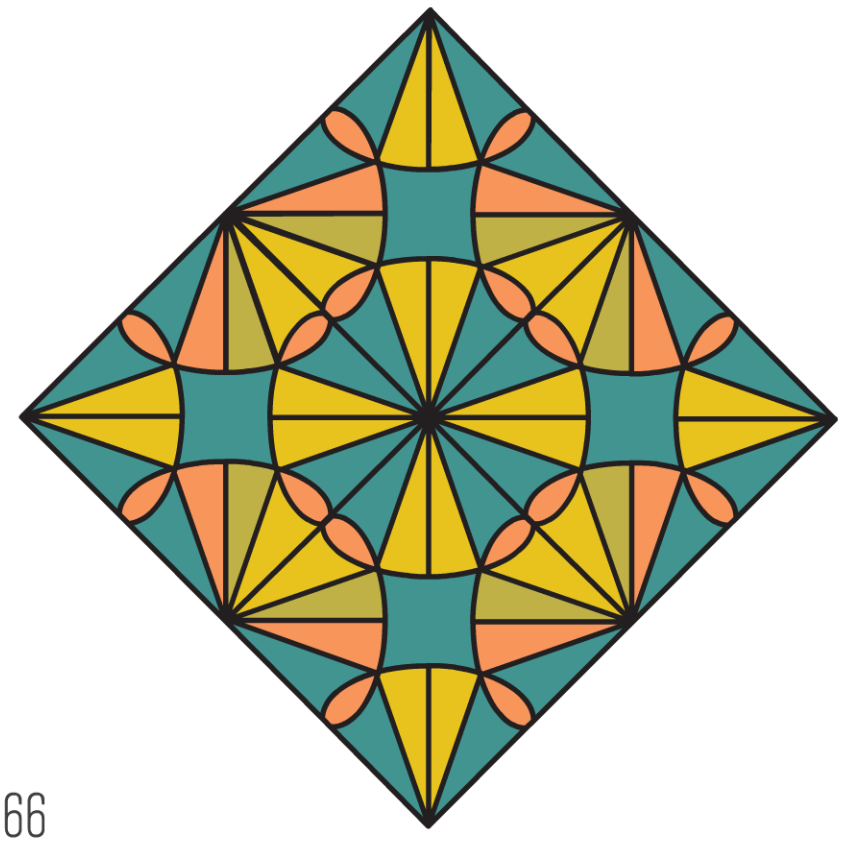

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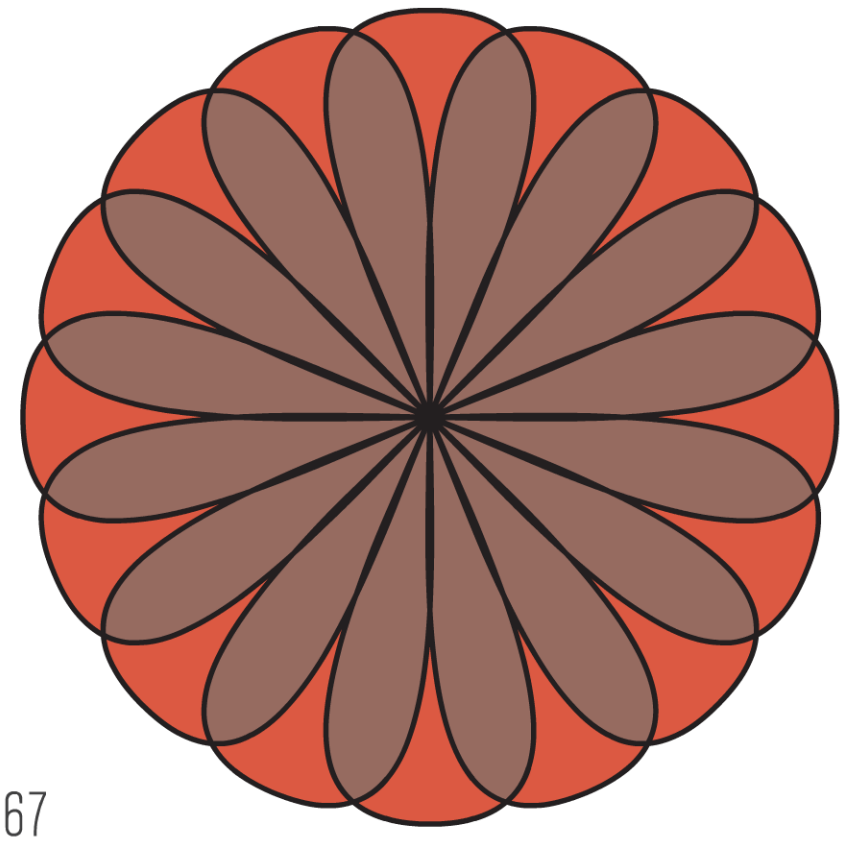
Figure 8



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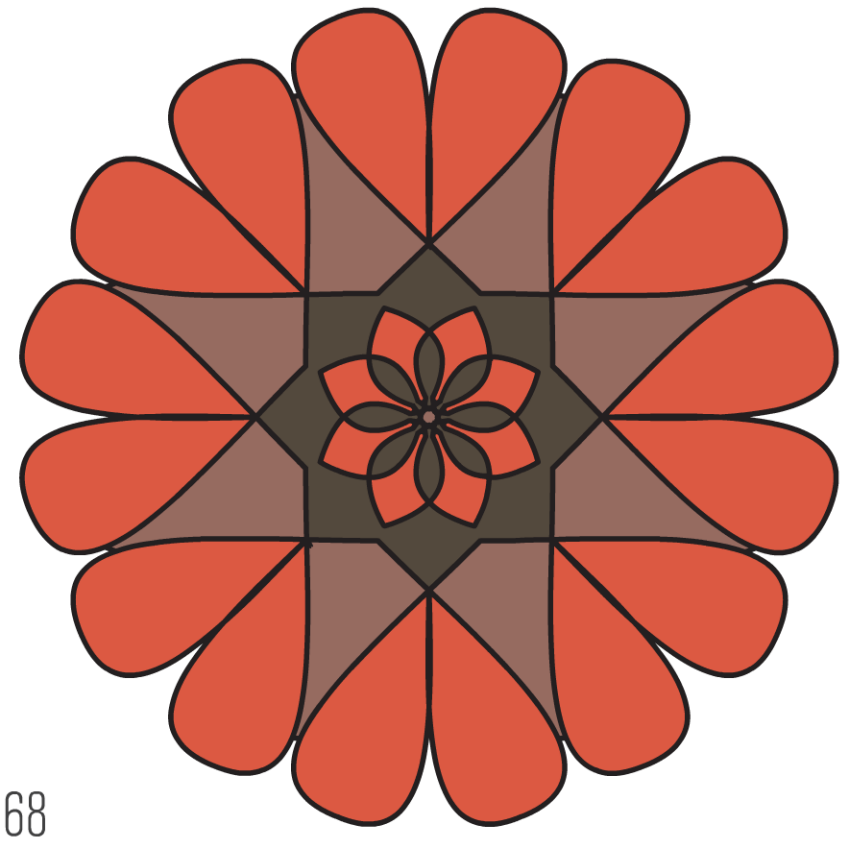

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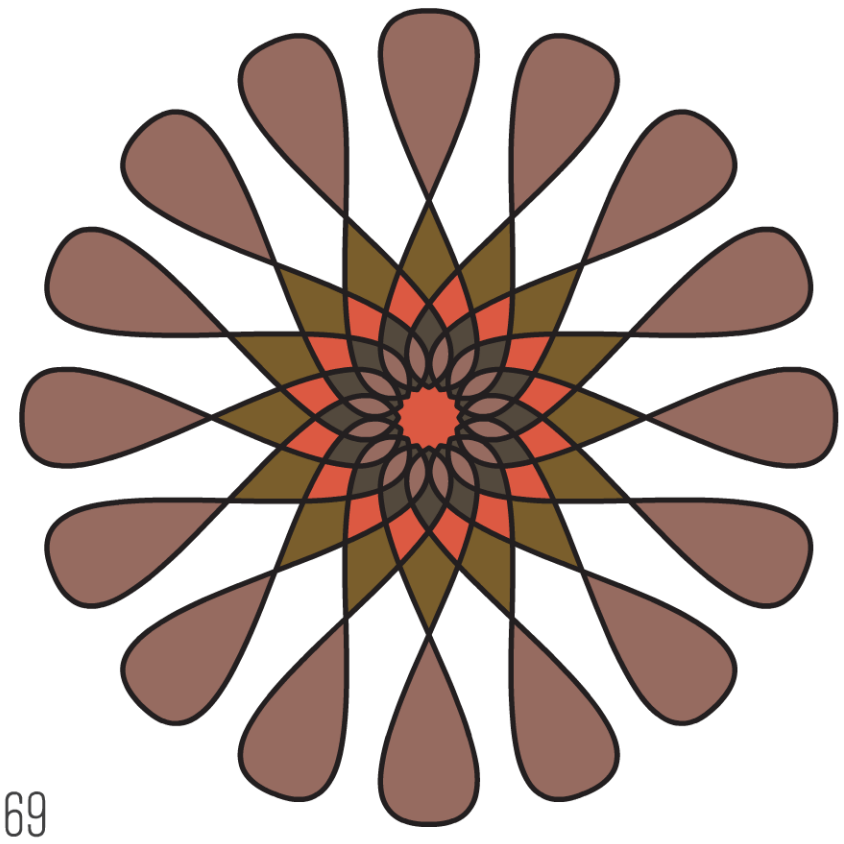

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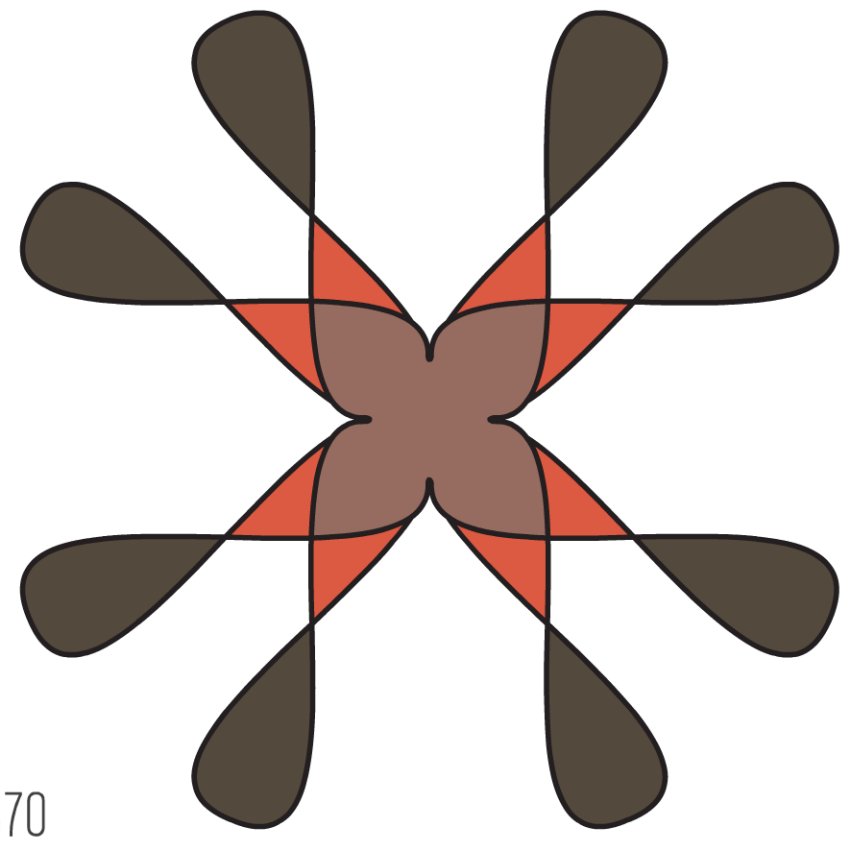

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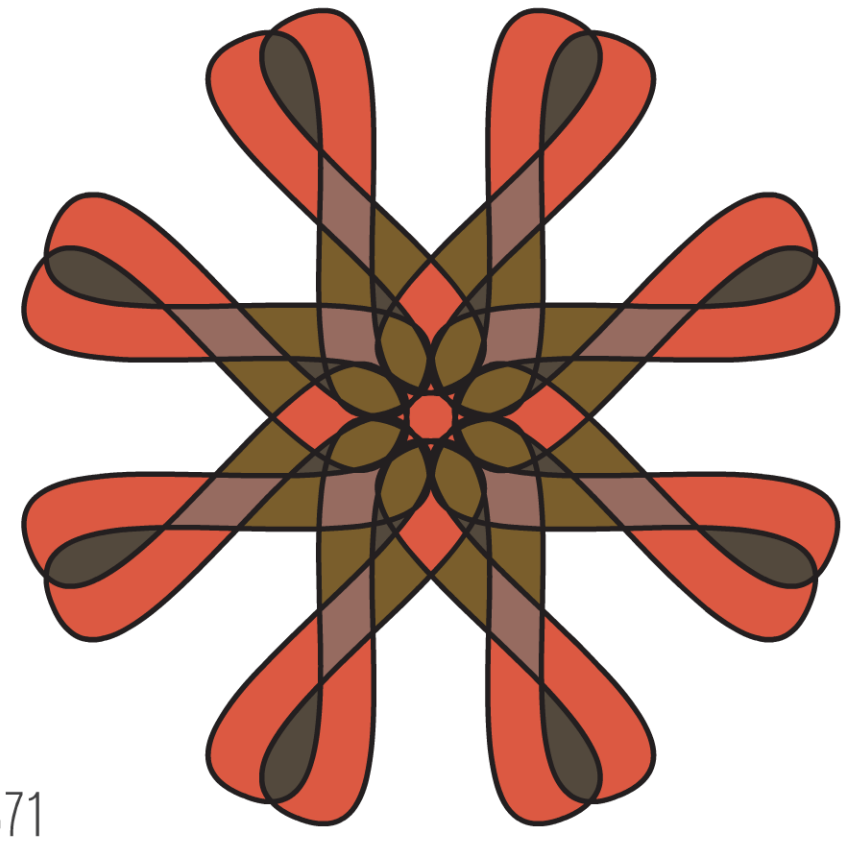

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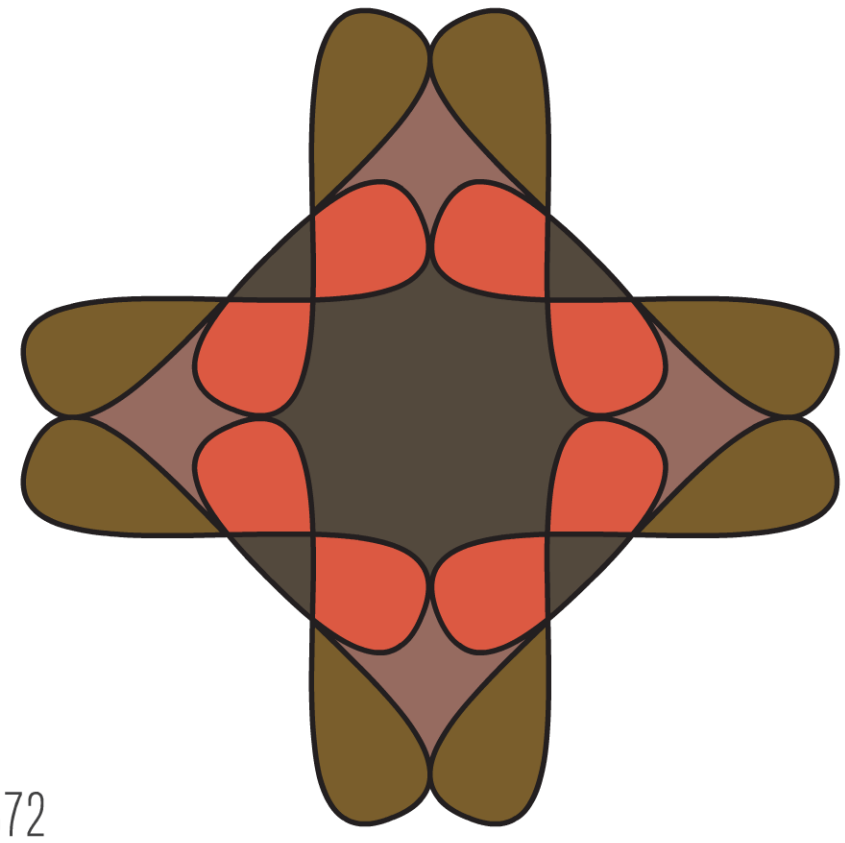

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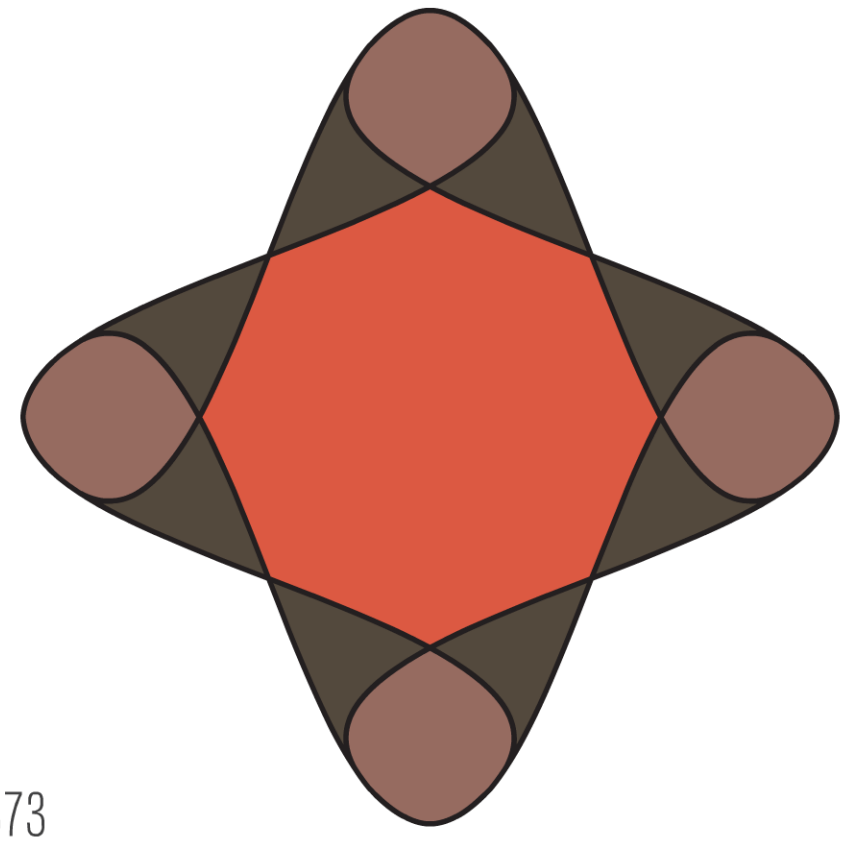

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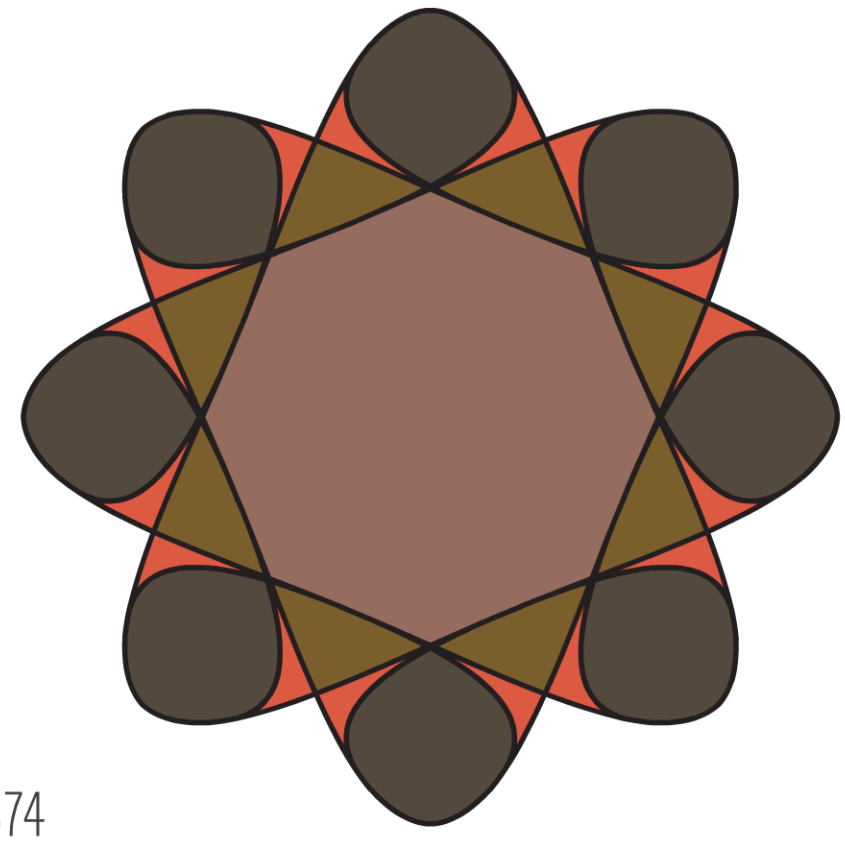

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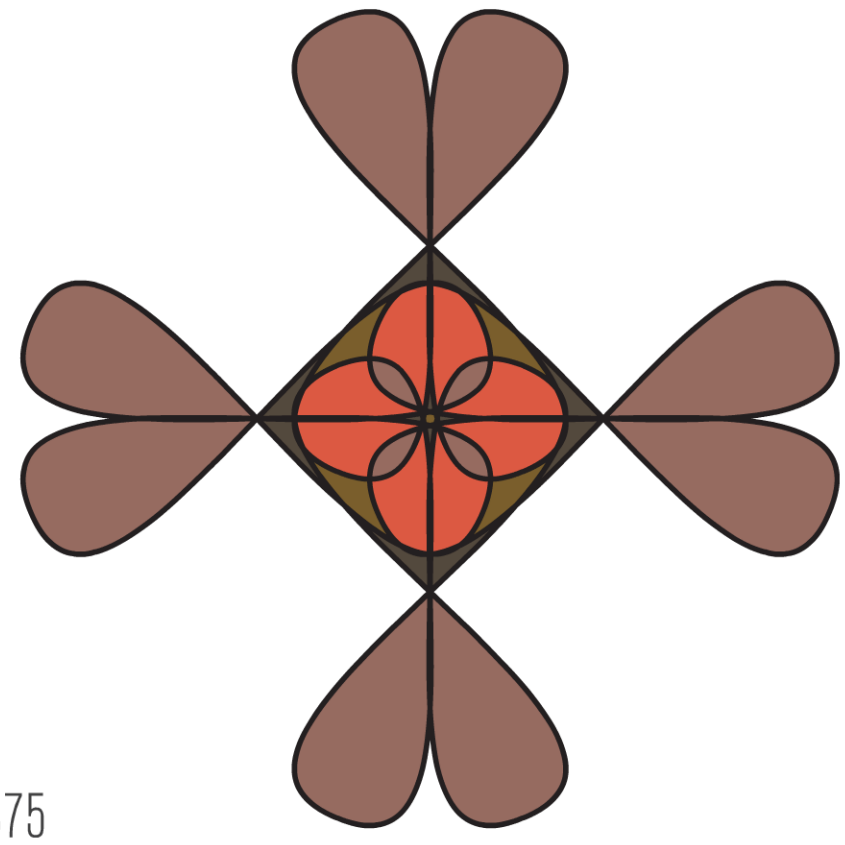

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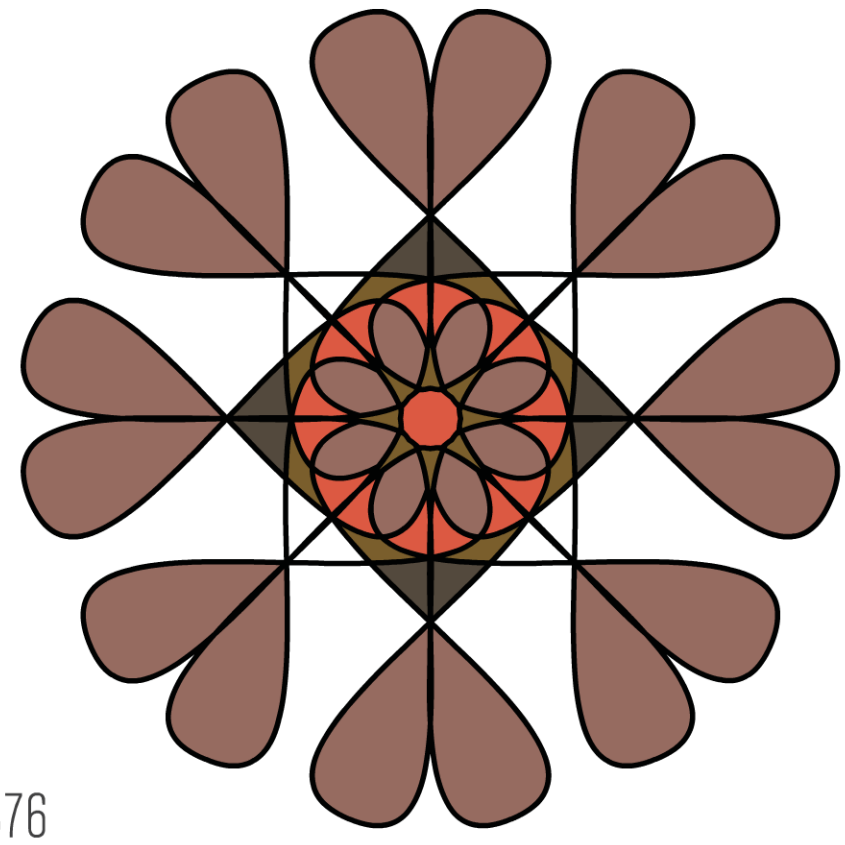

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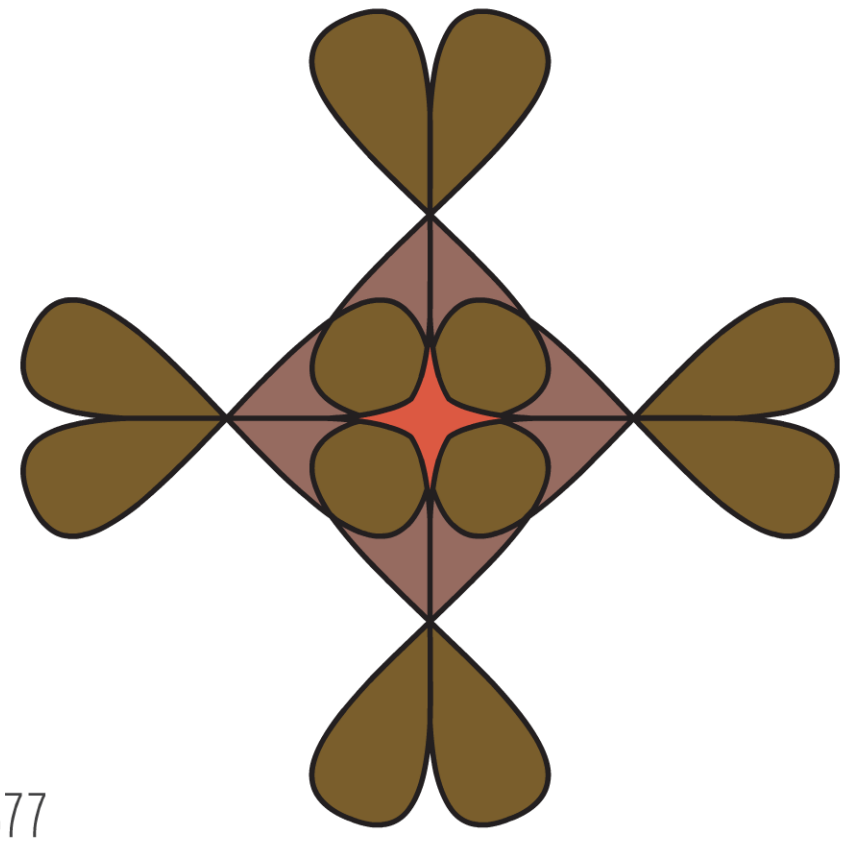

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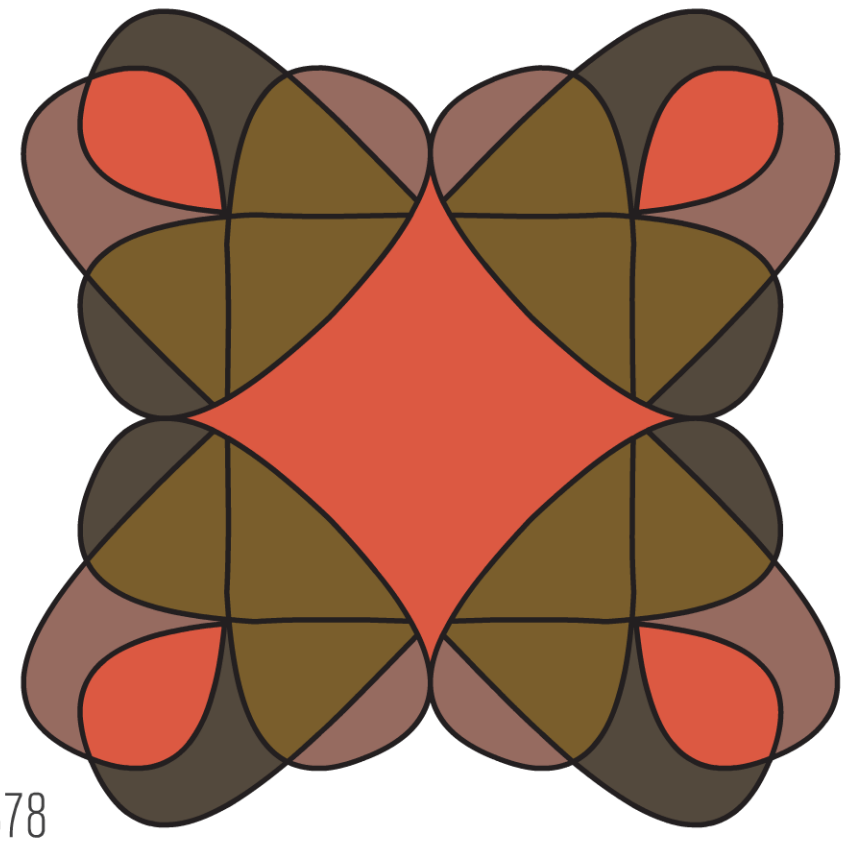

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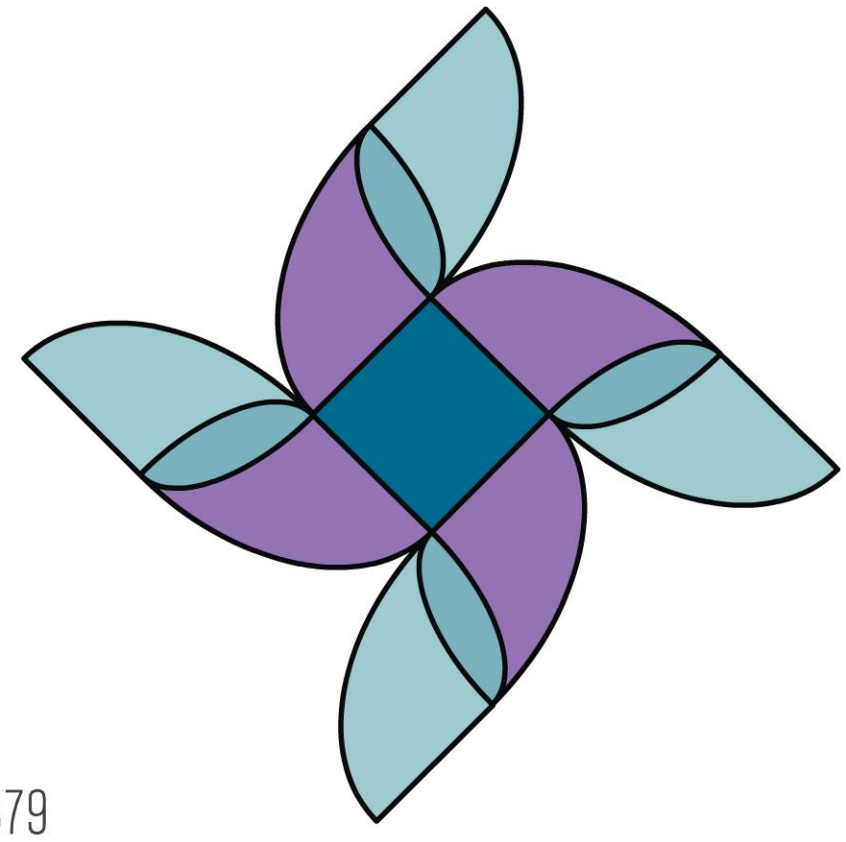

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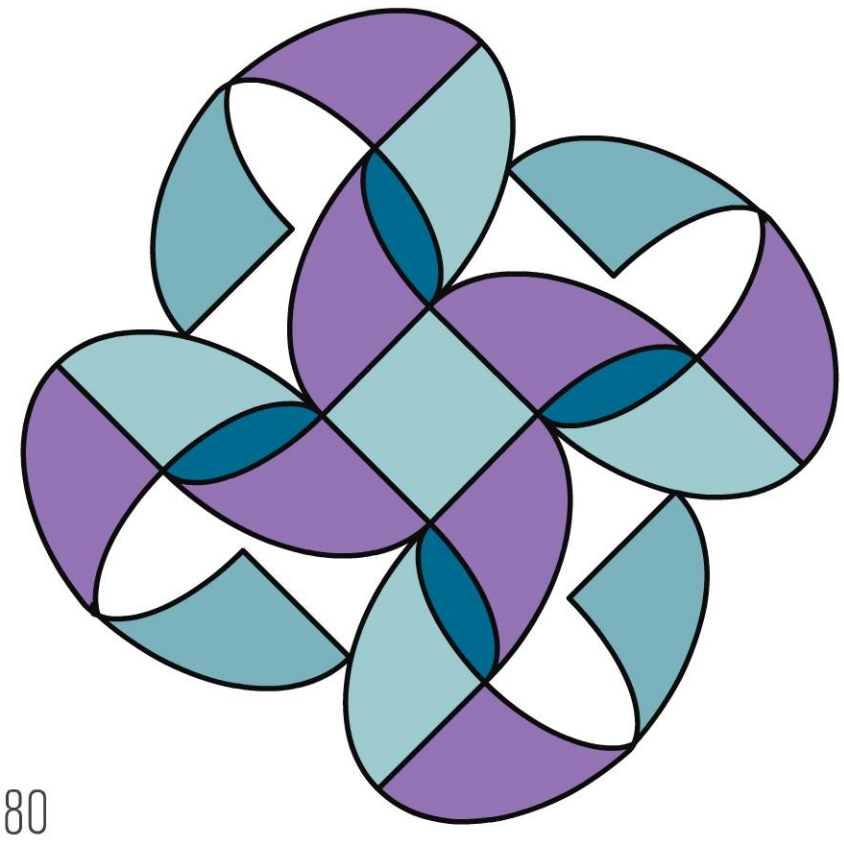

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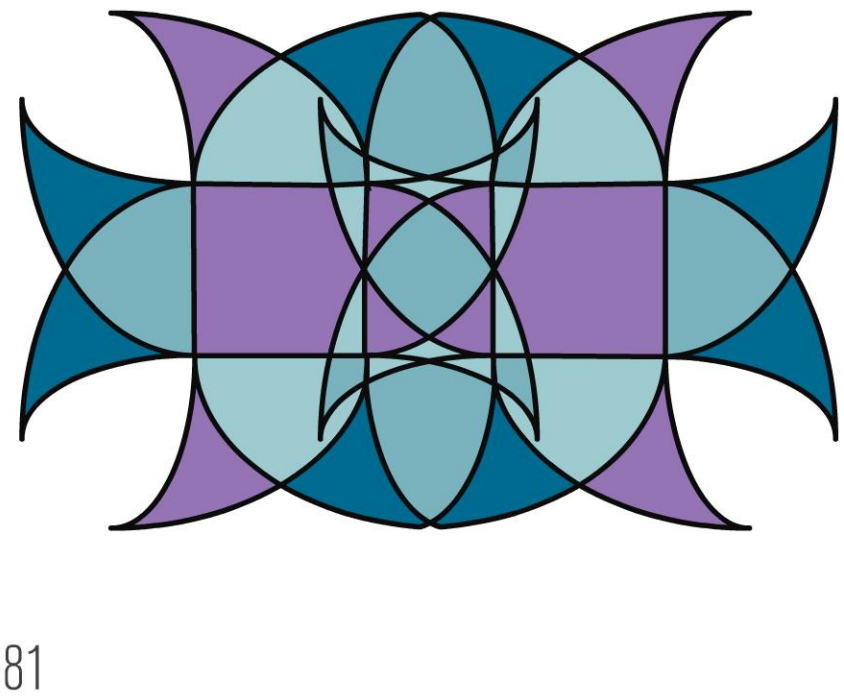

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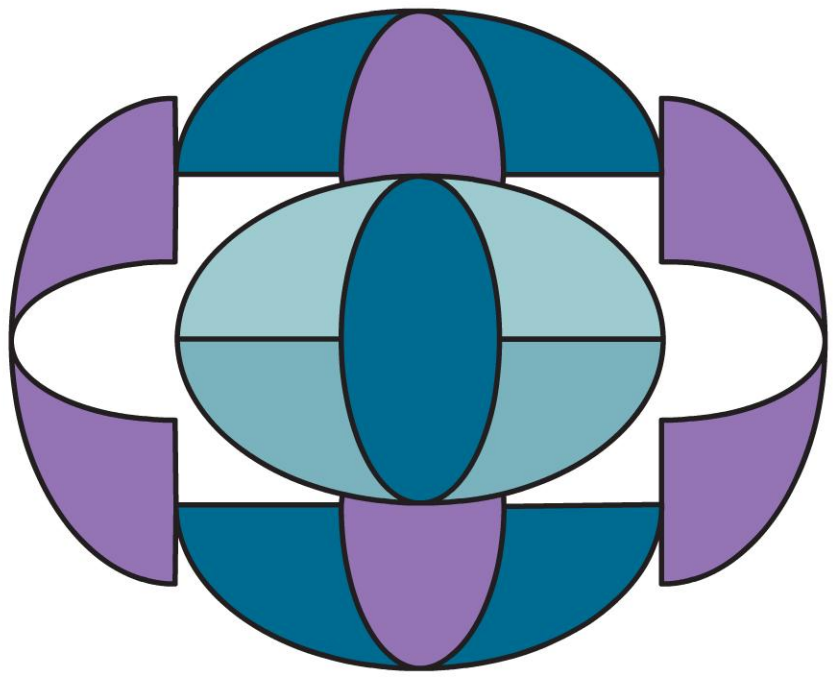

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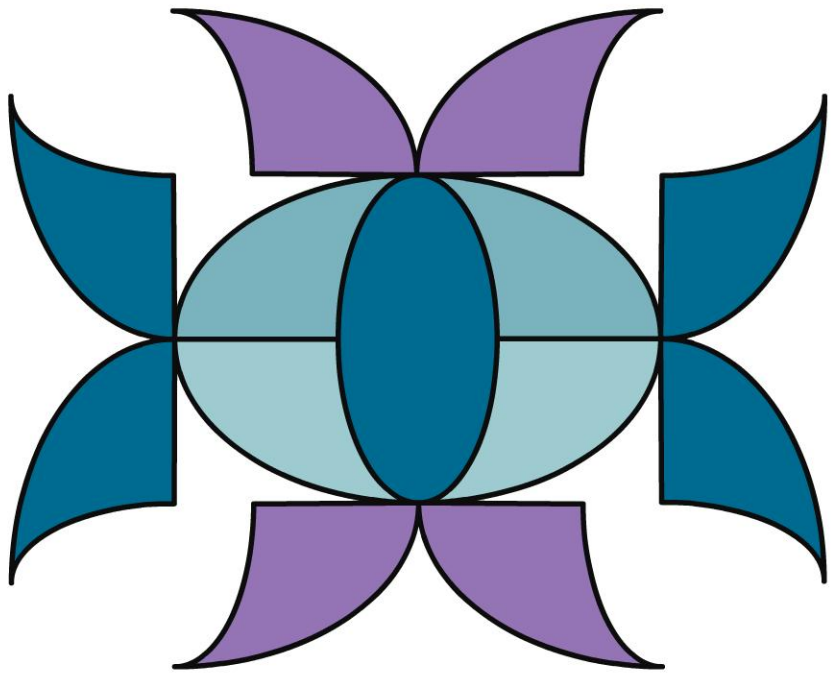

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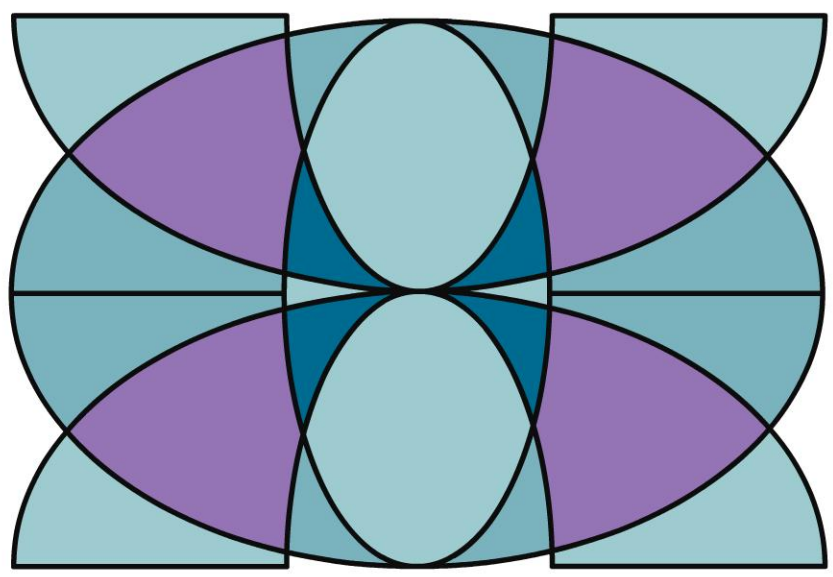

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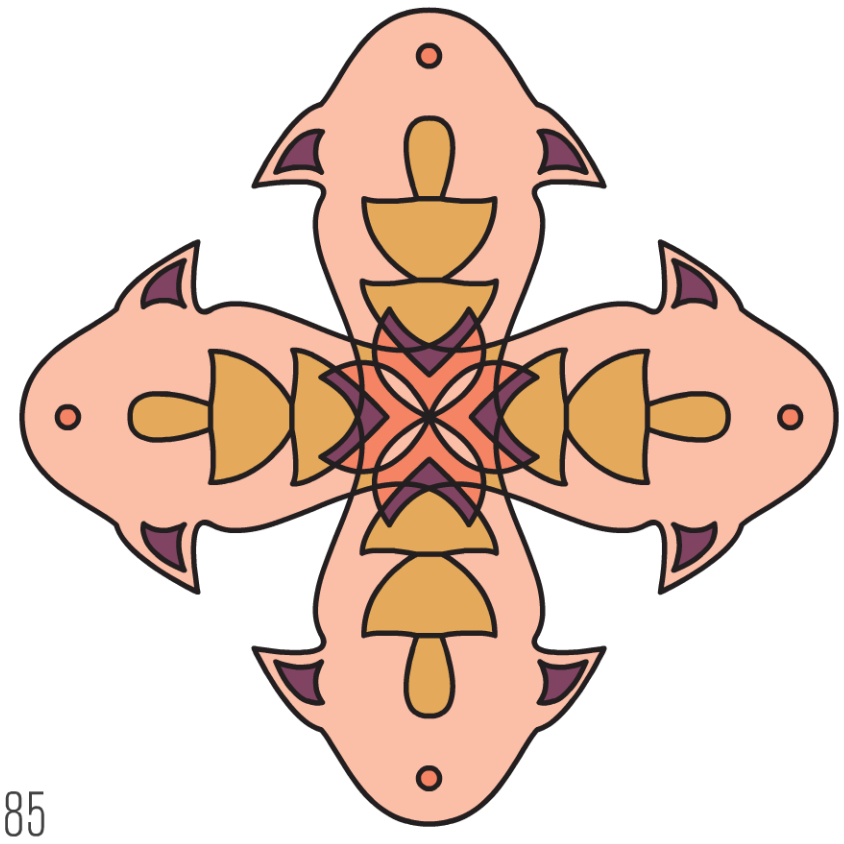

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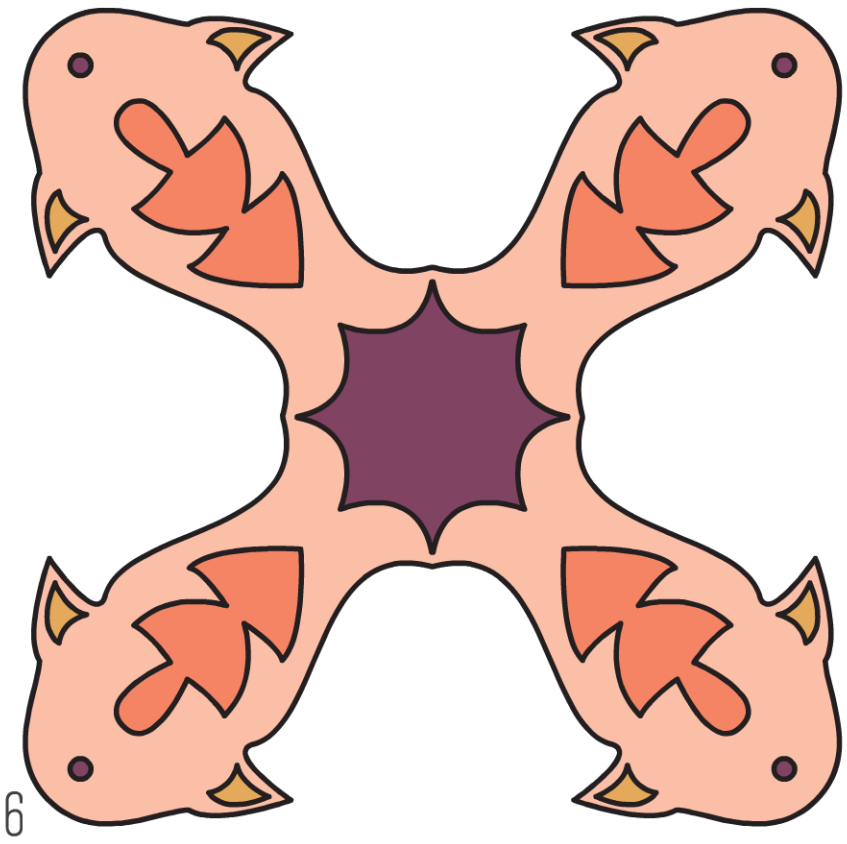

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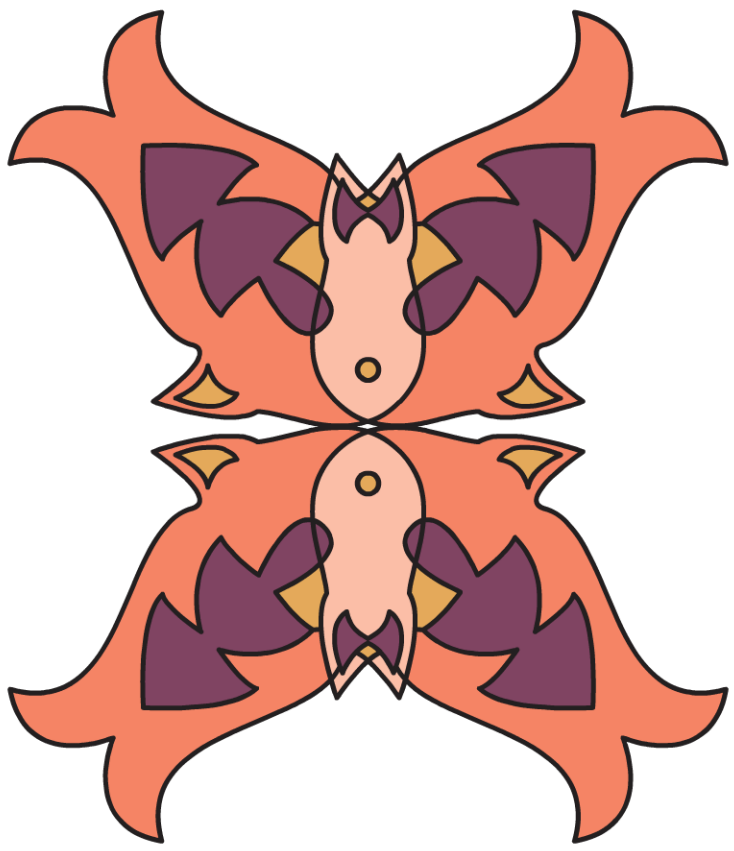

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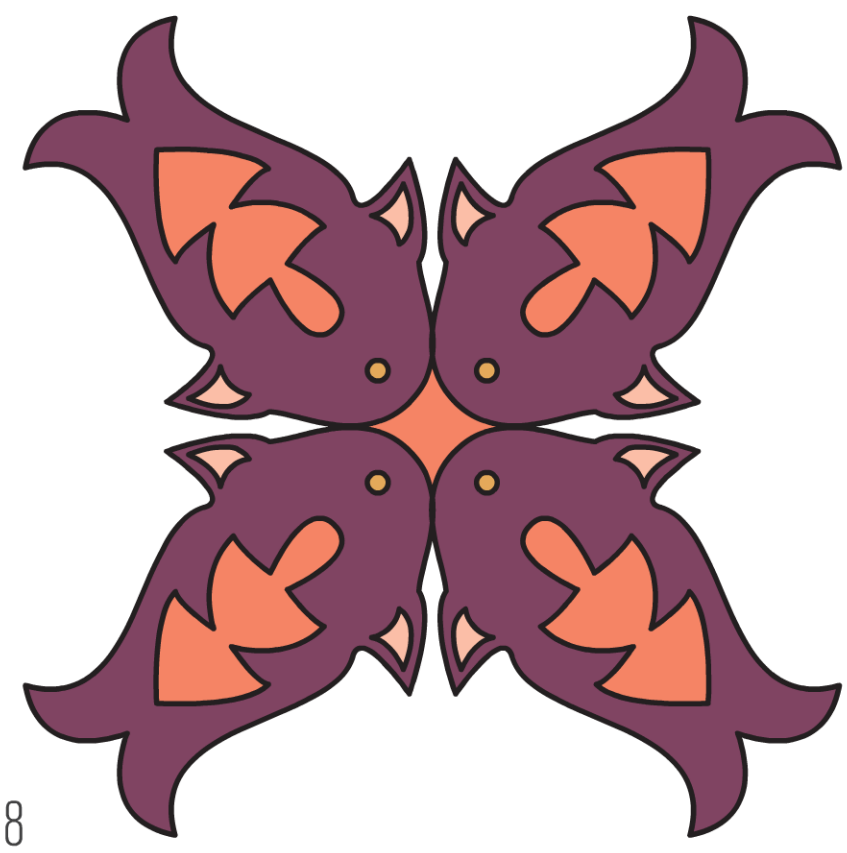

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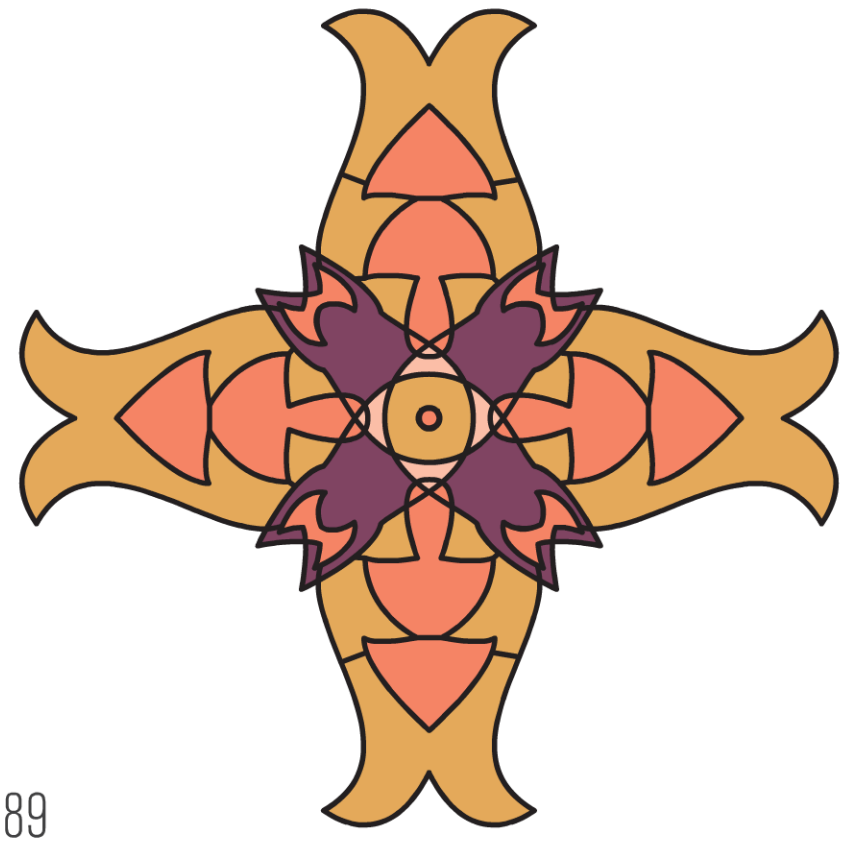

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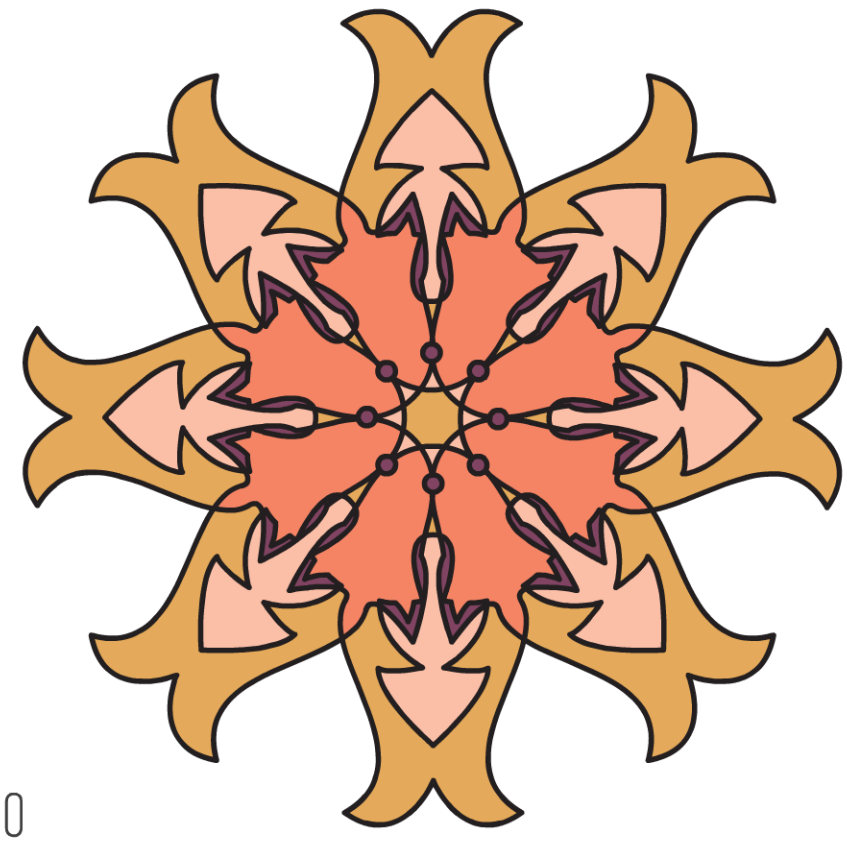

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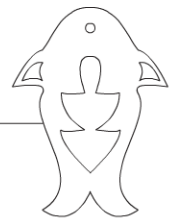

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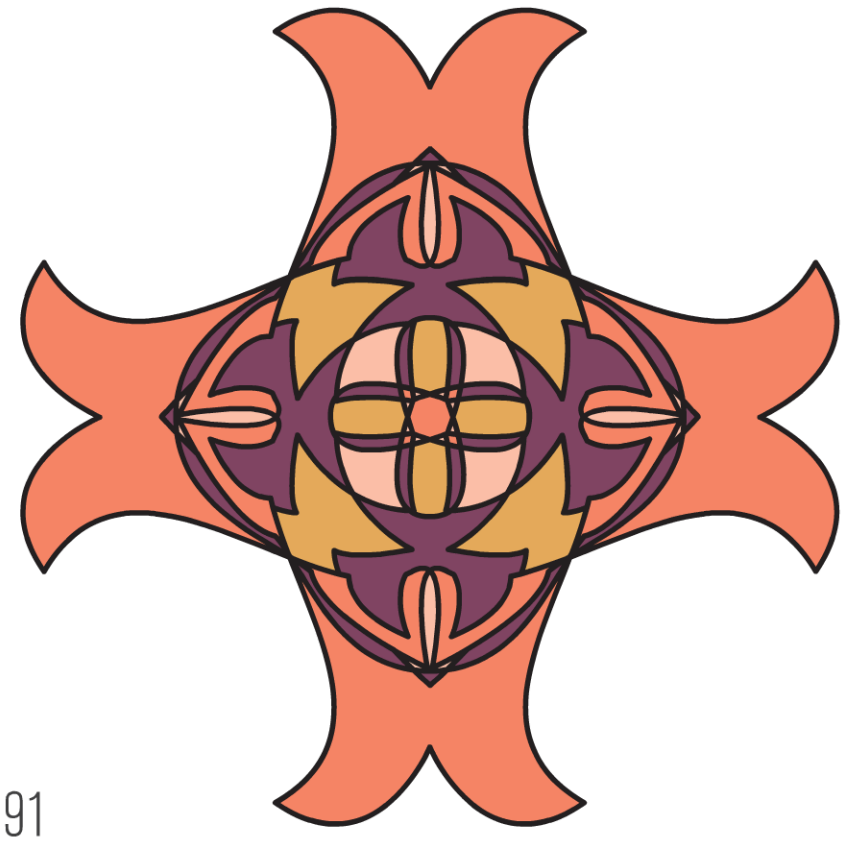

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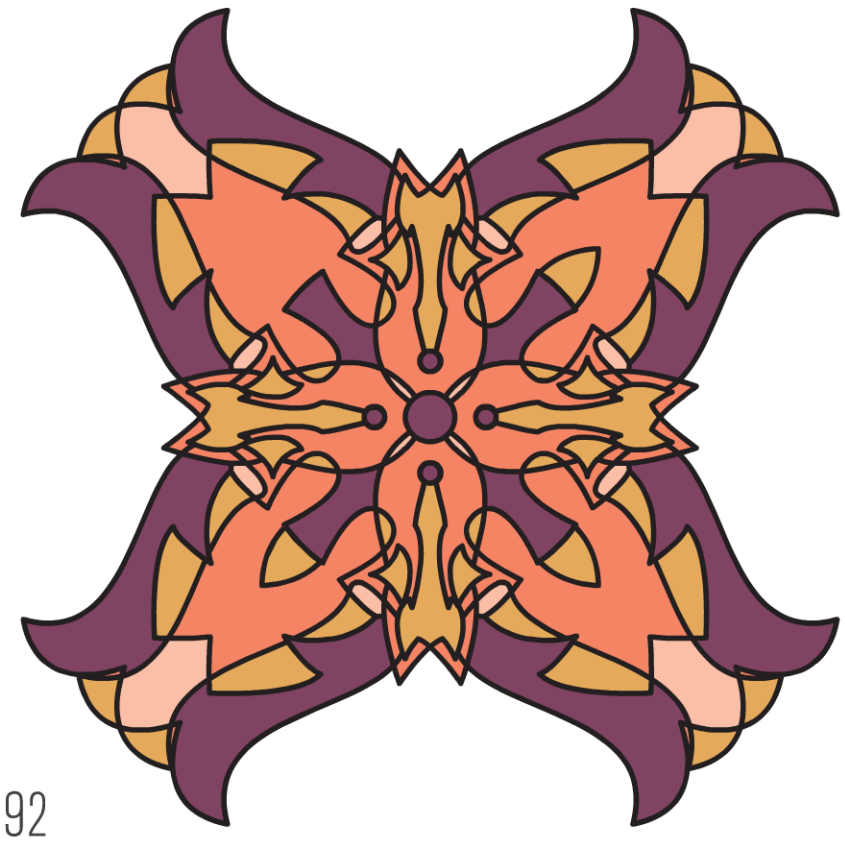

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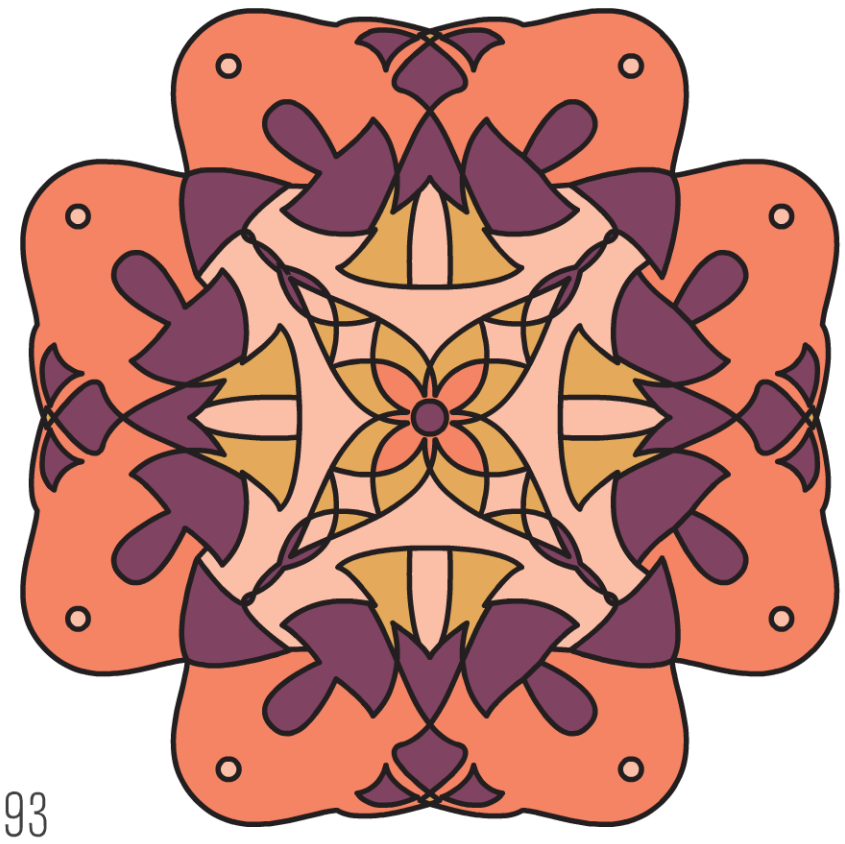

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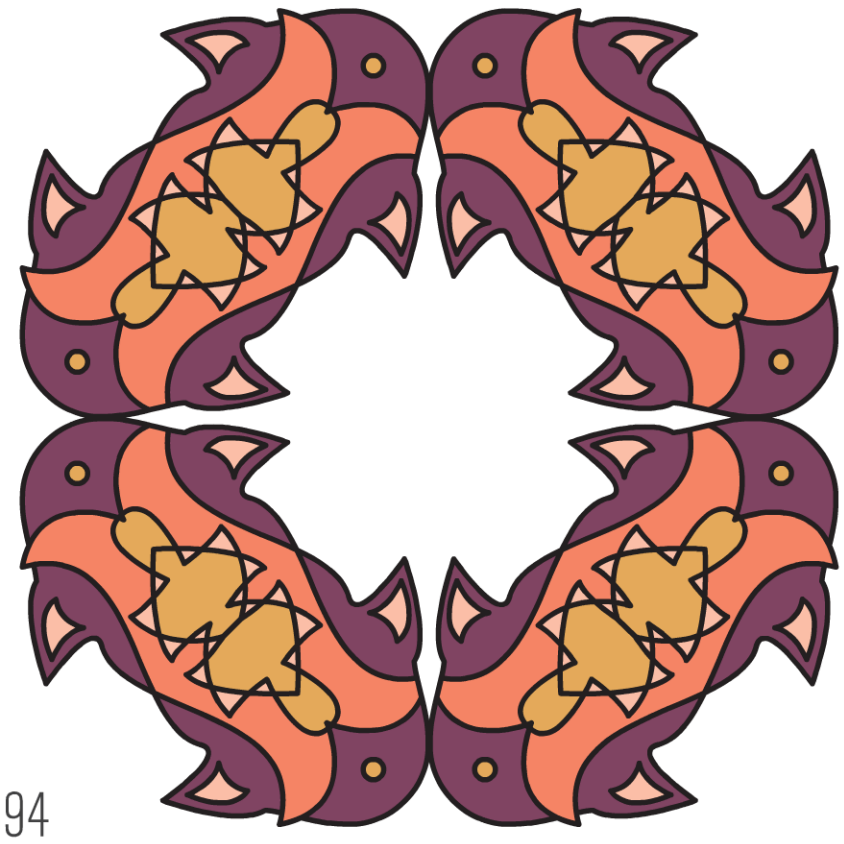

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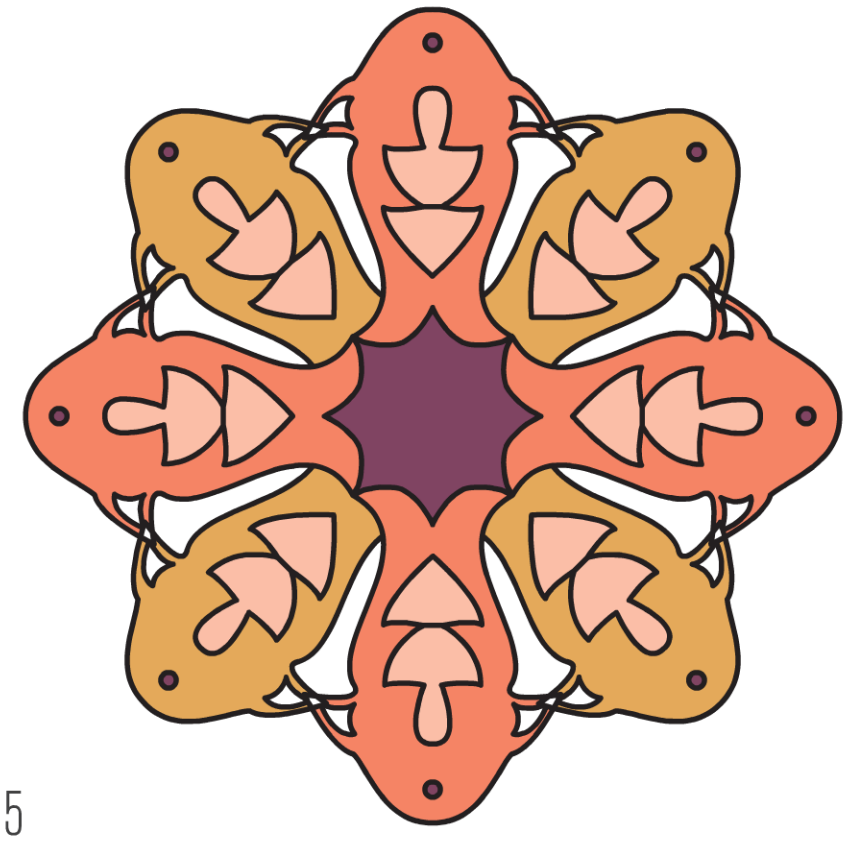

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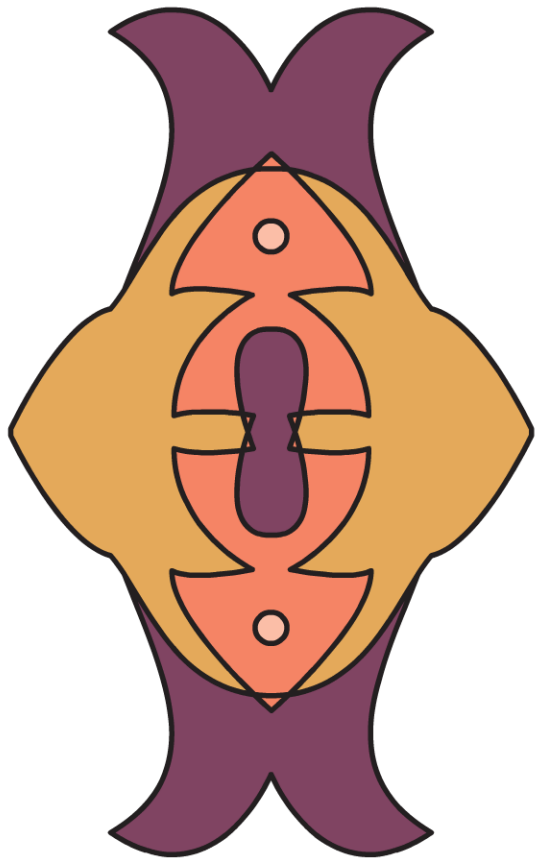

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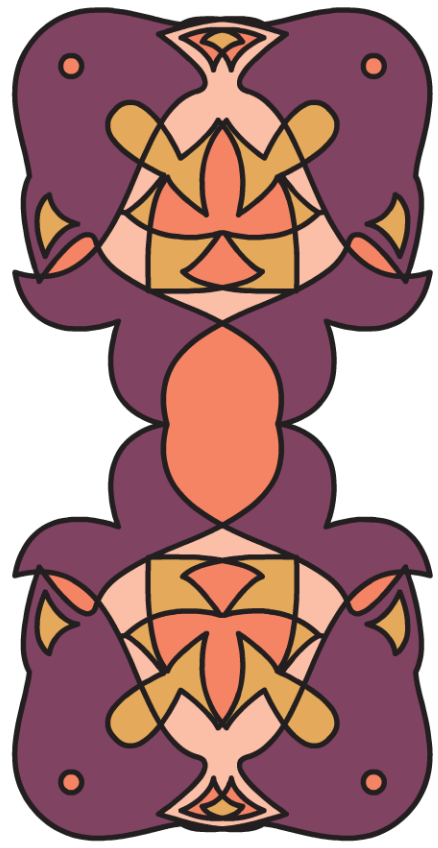

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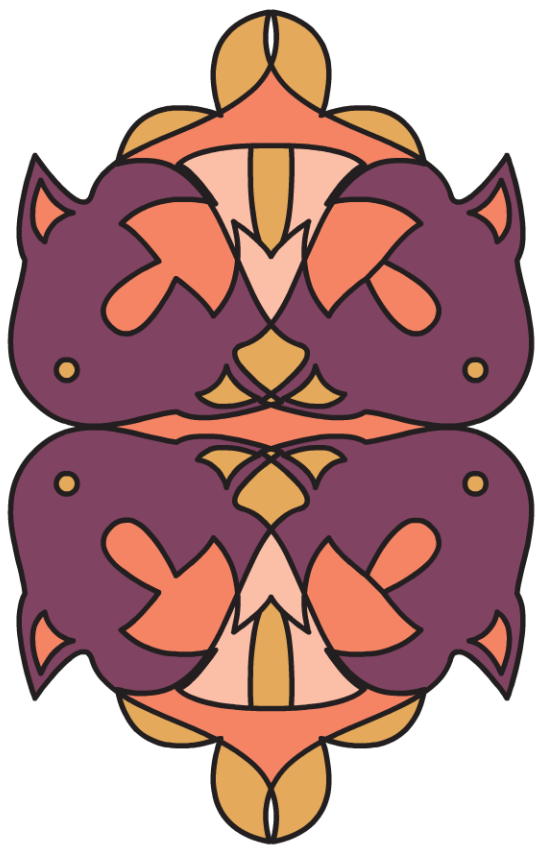

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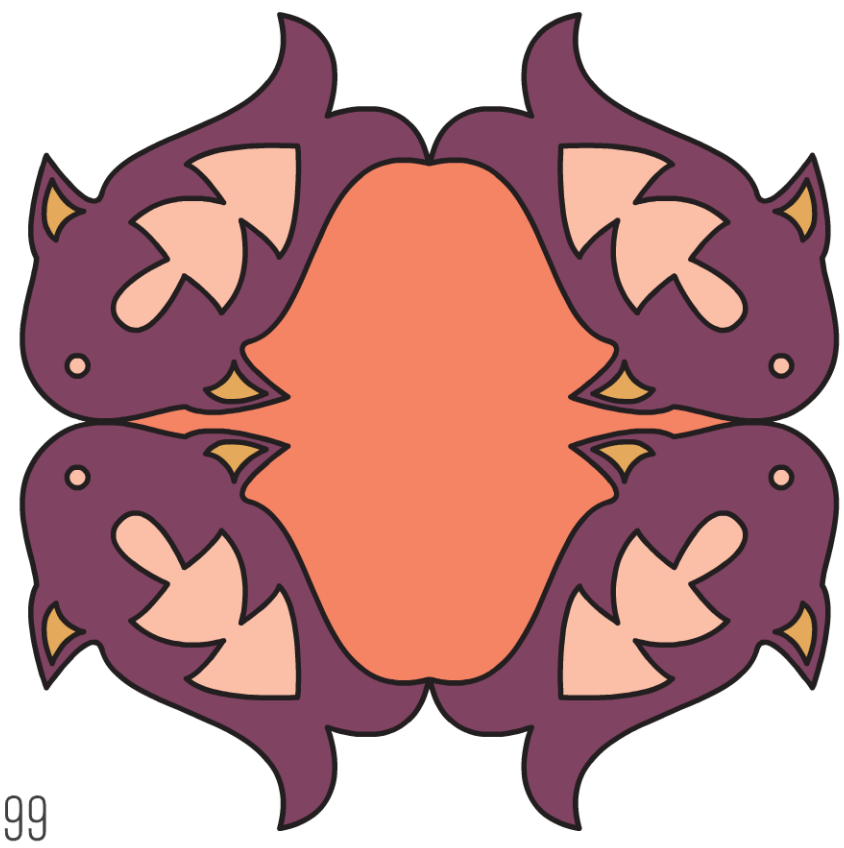

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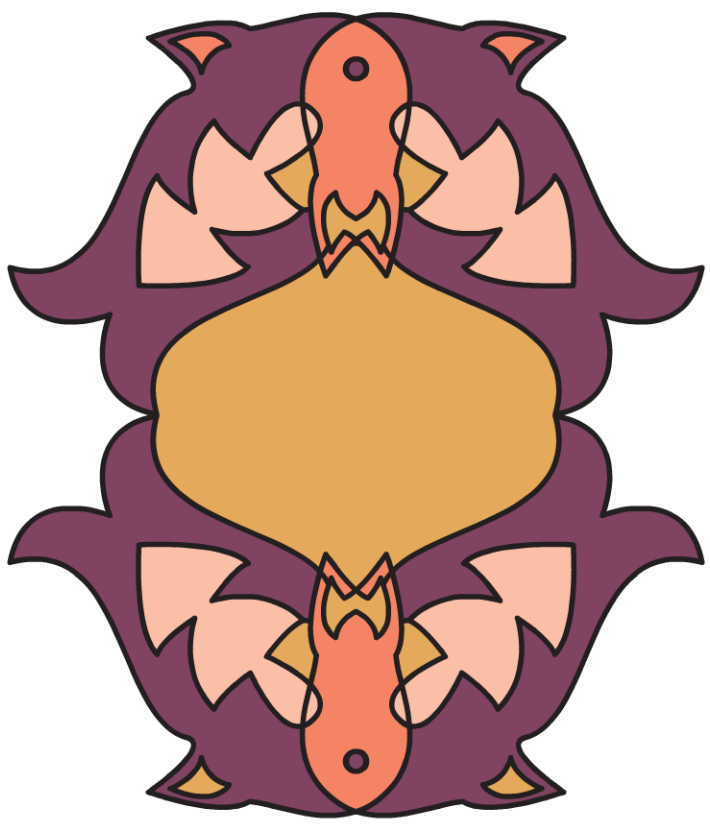

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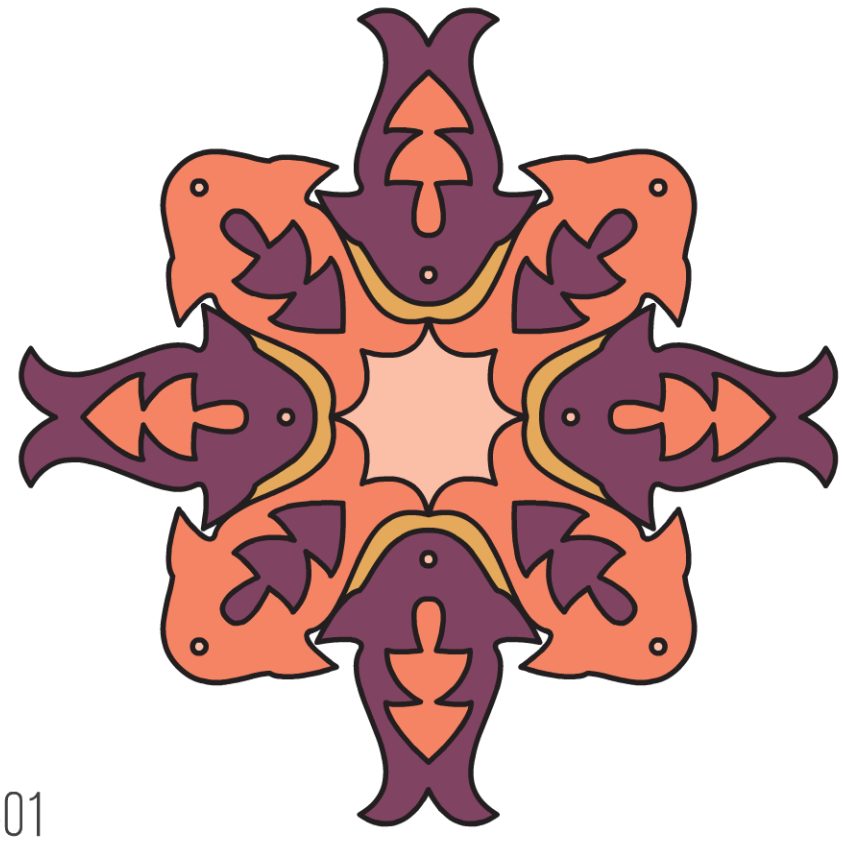

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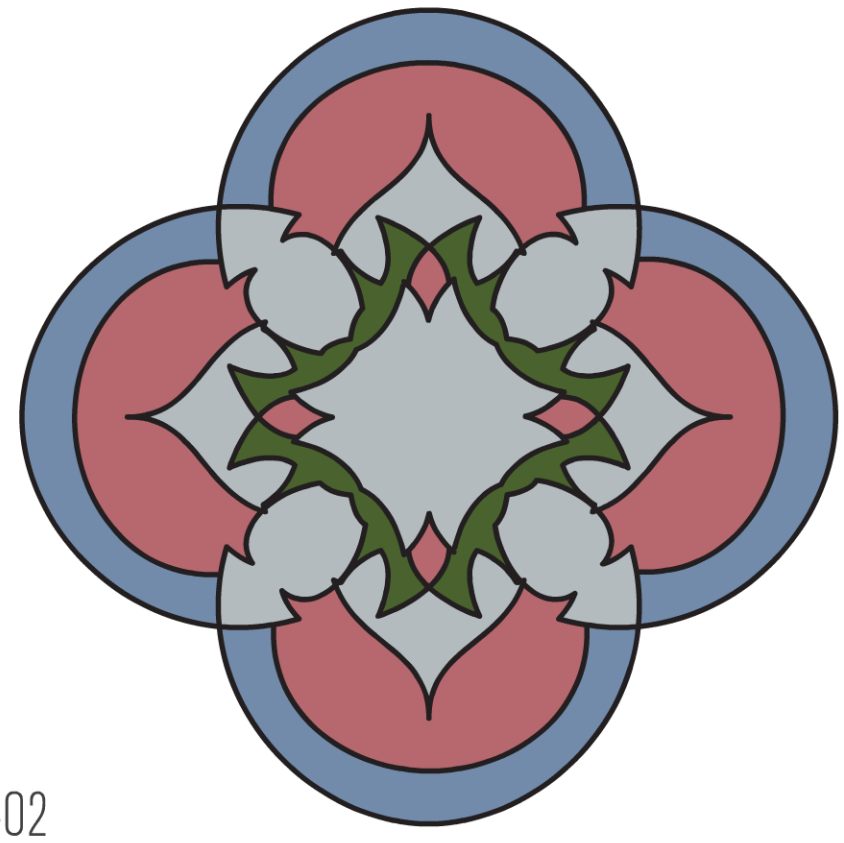
Fleur de lis



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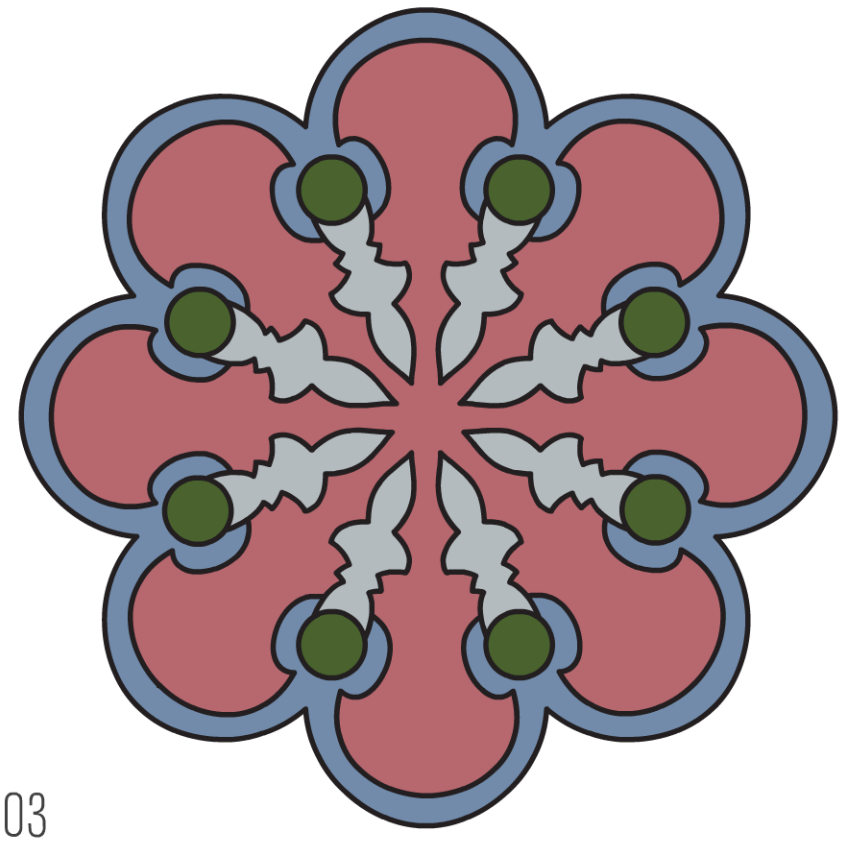

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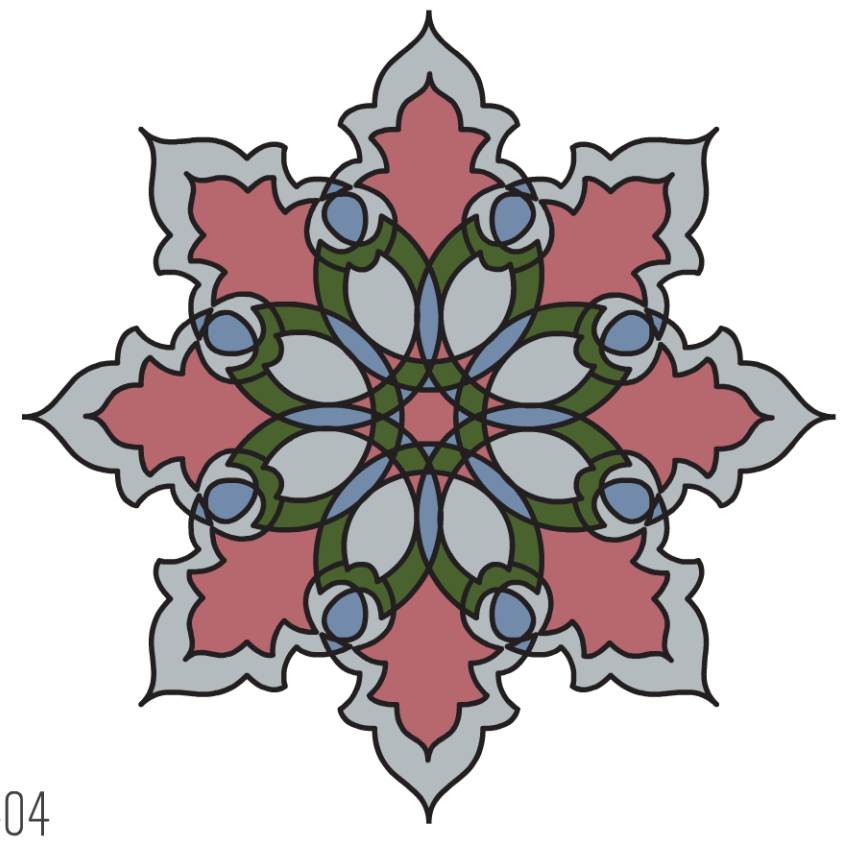

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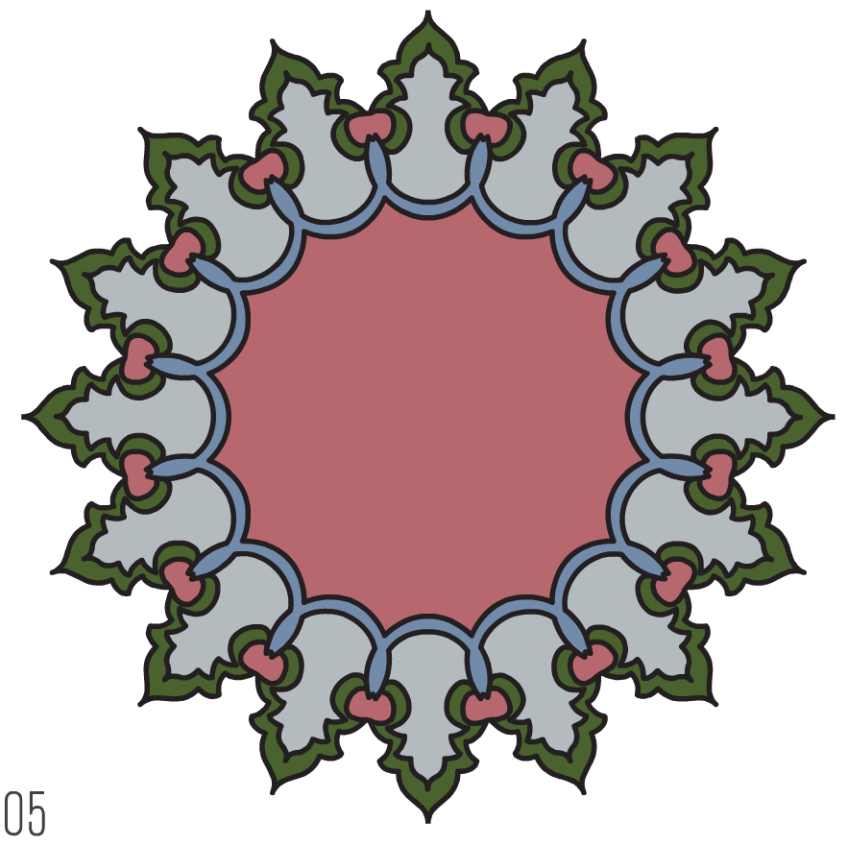

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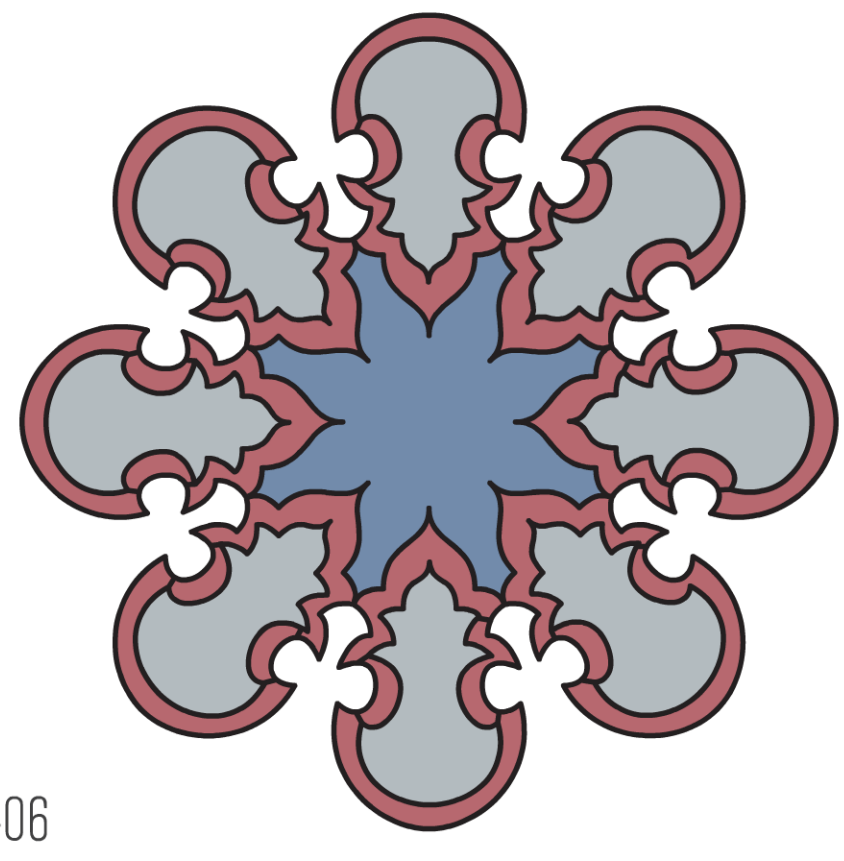

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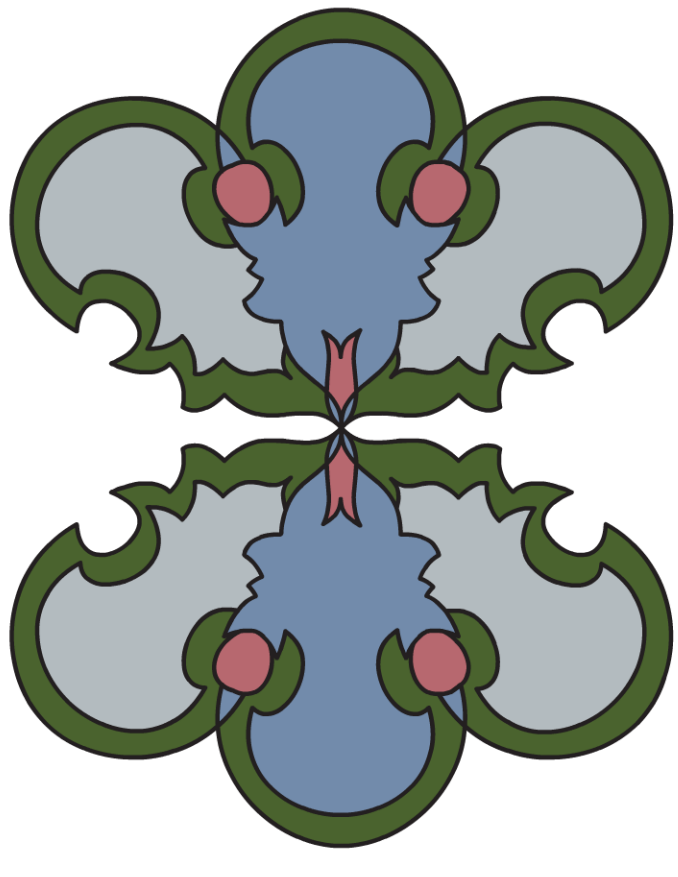

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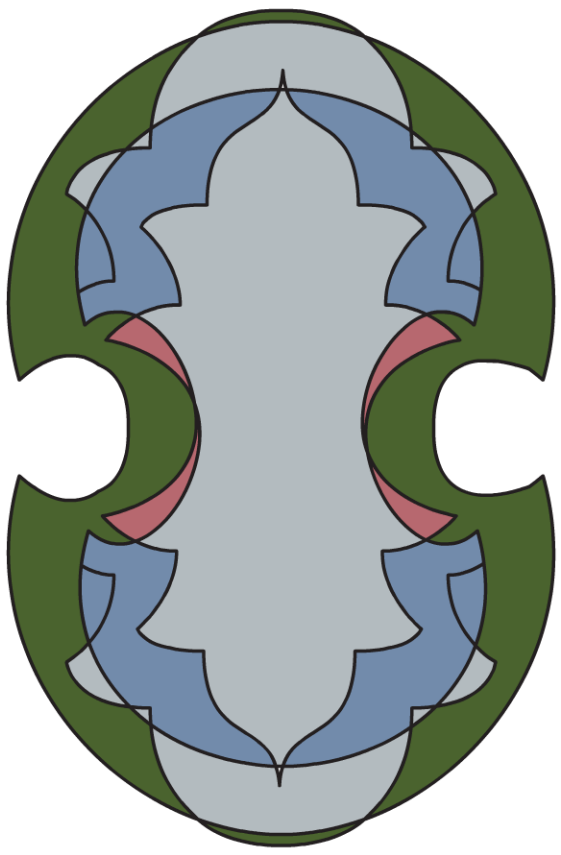

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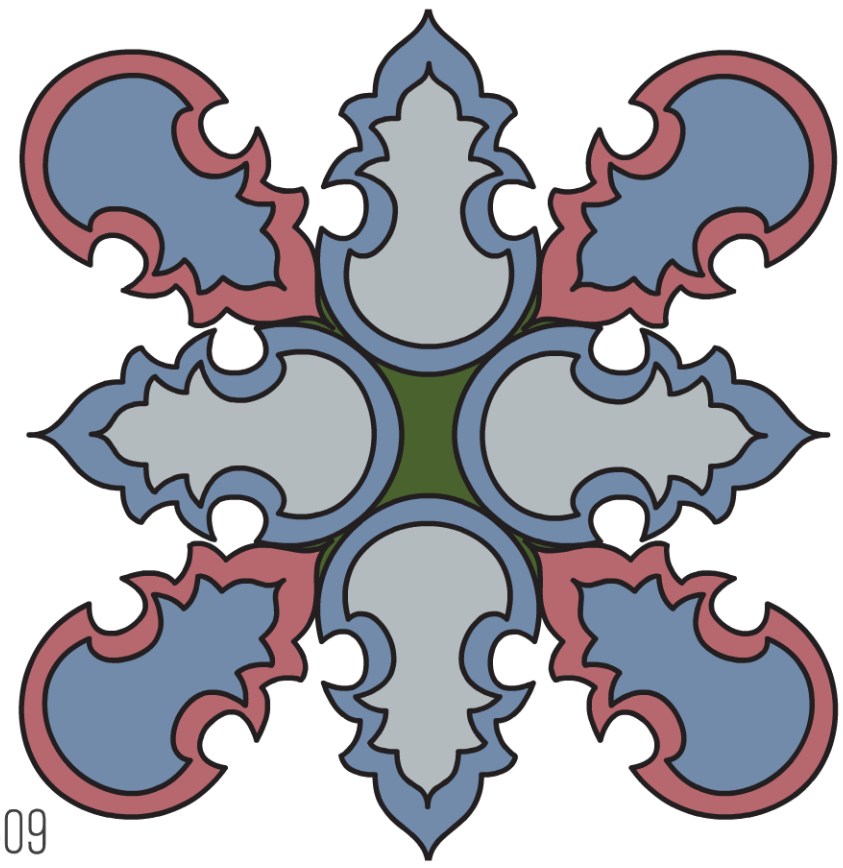

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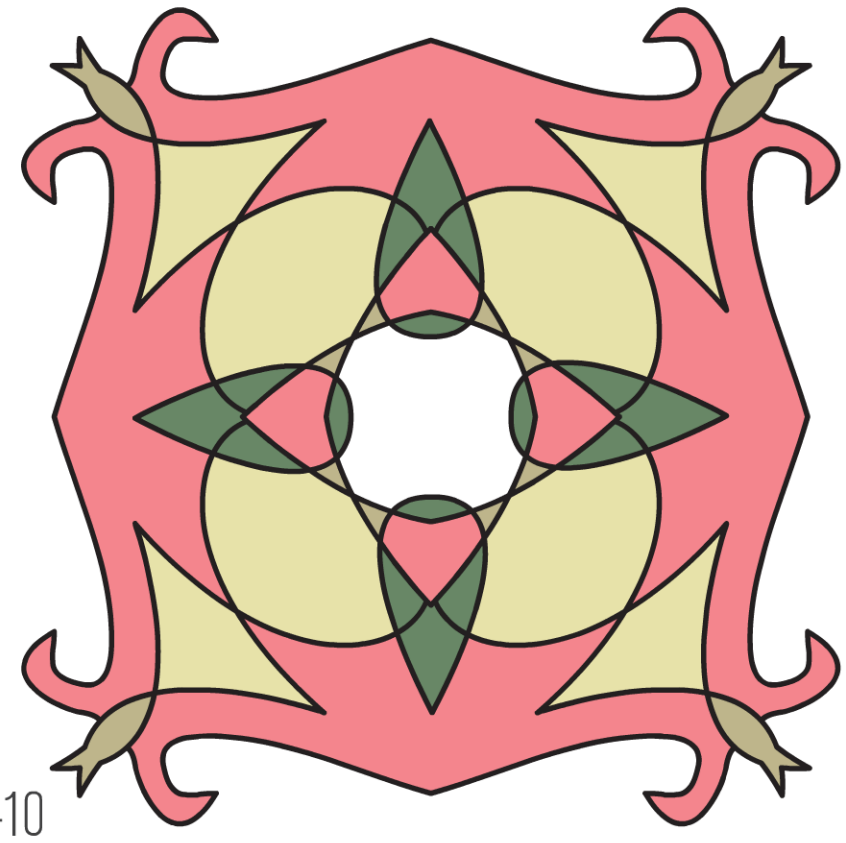
Fleur de lis 2



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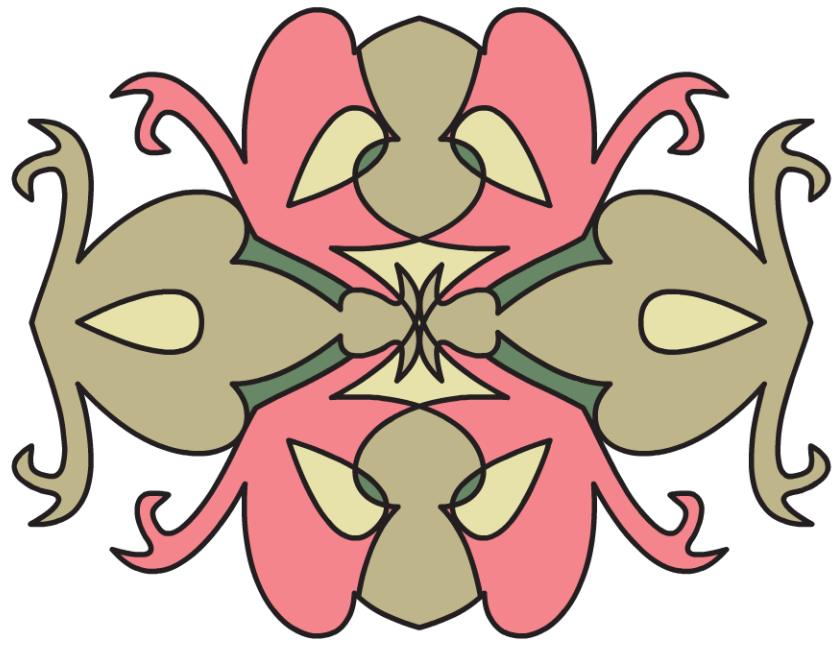

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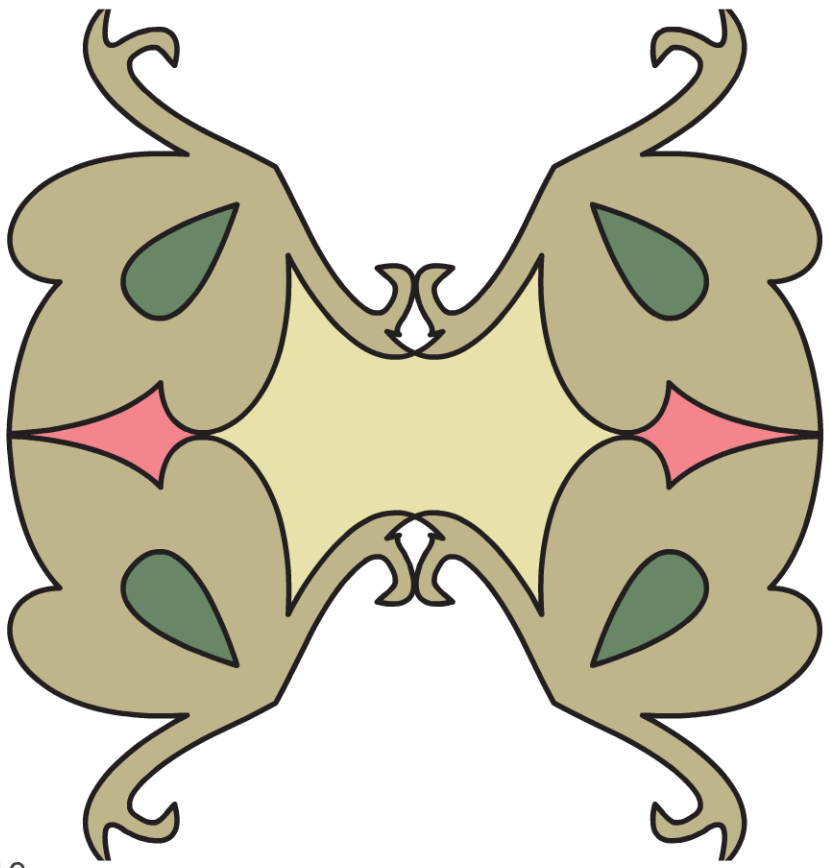

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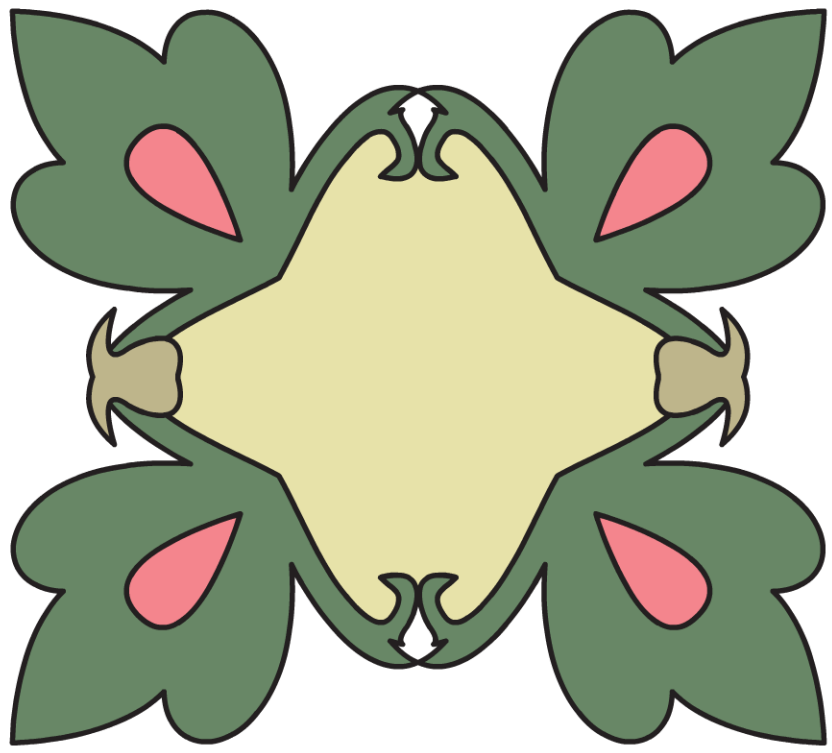

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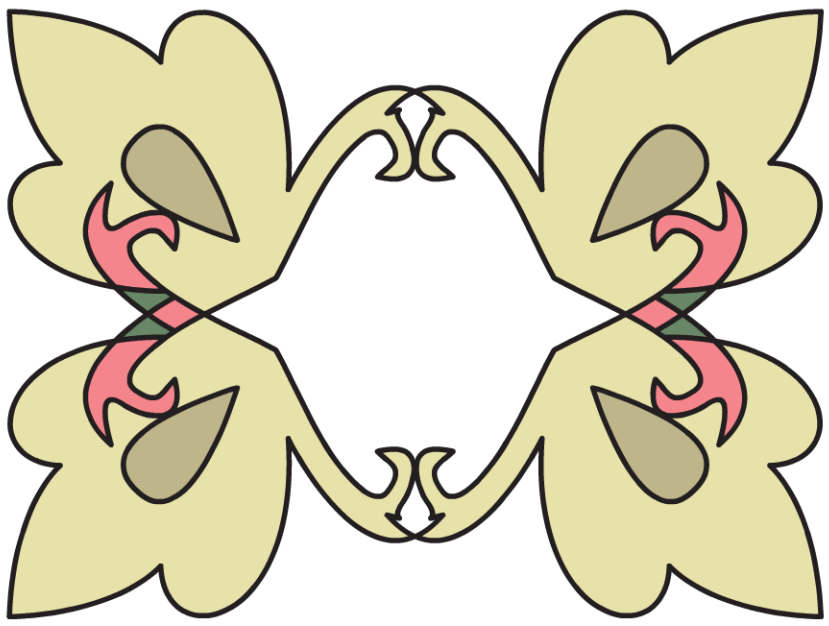

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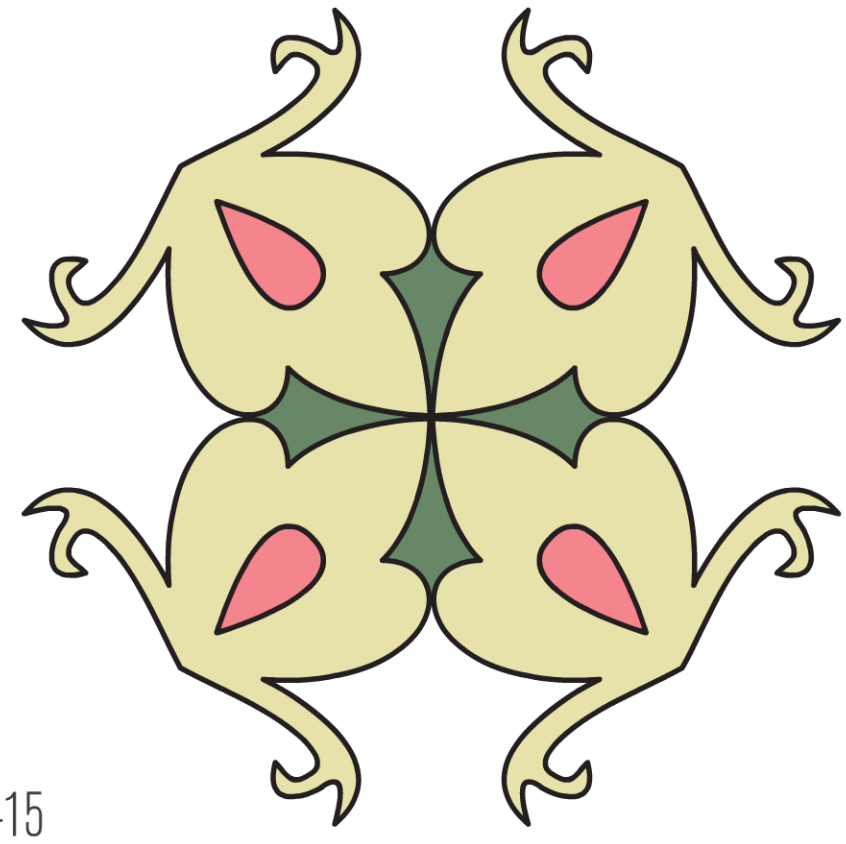

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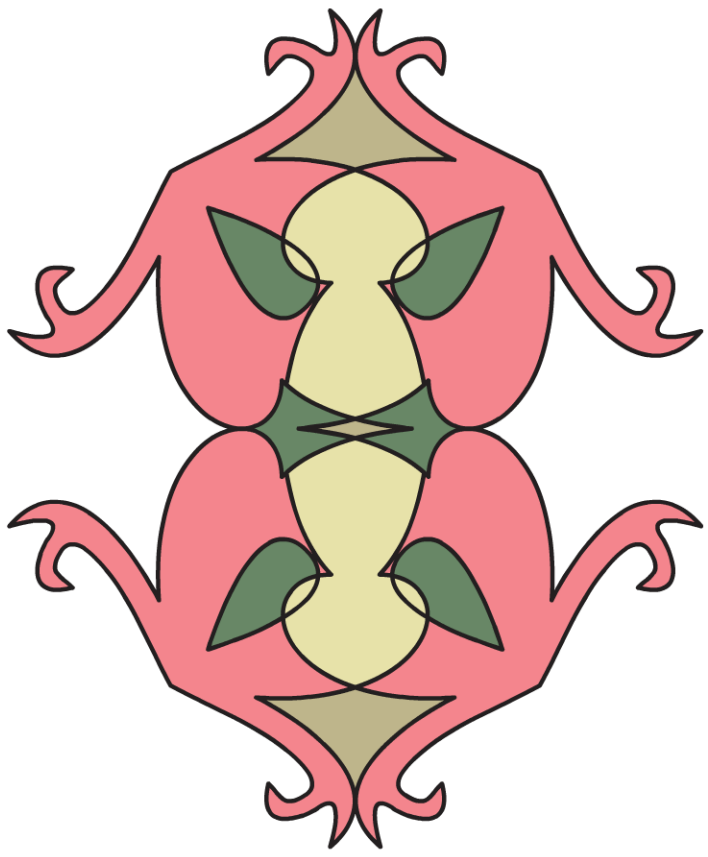

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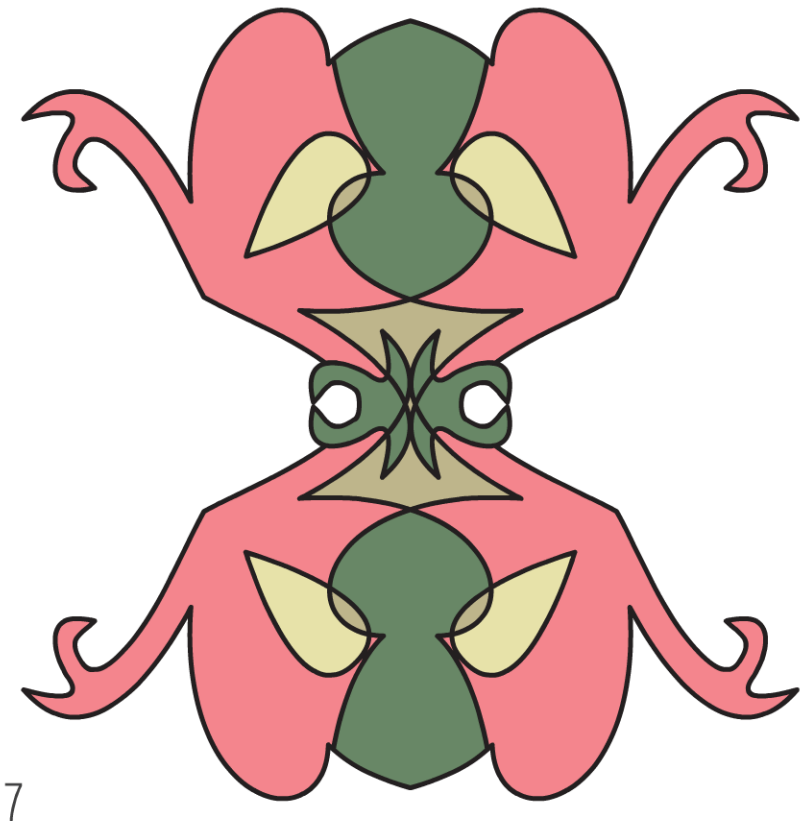

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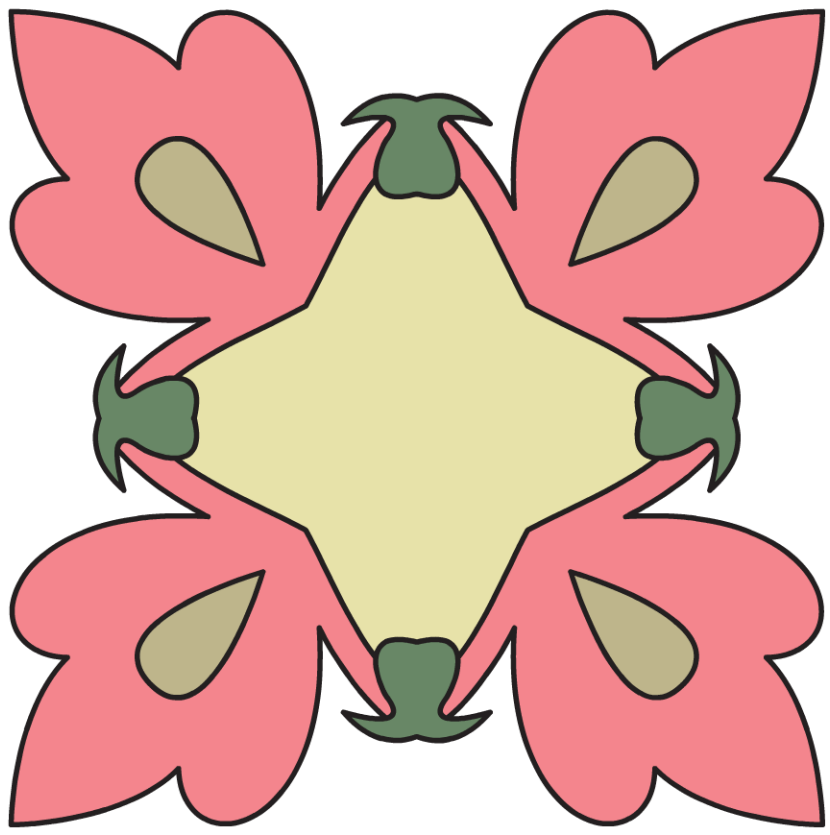

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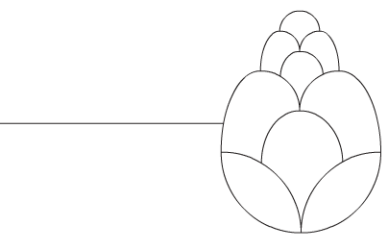
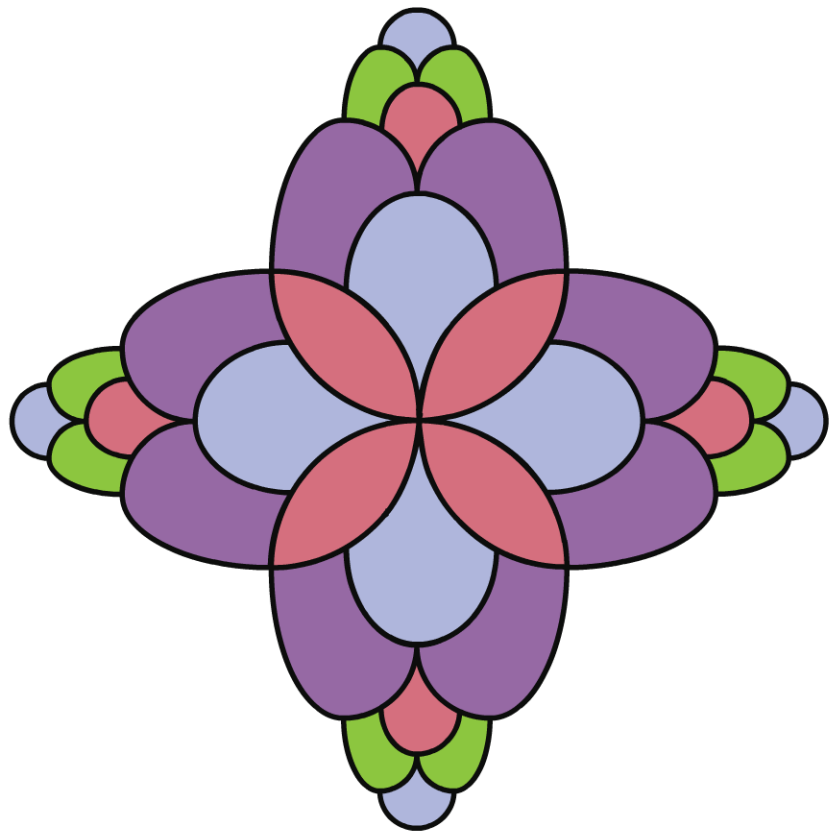


Floral



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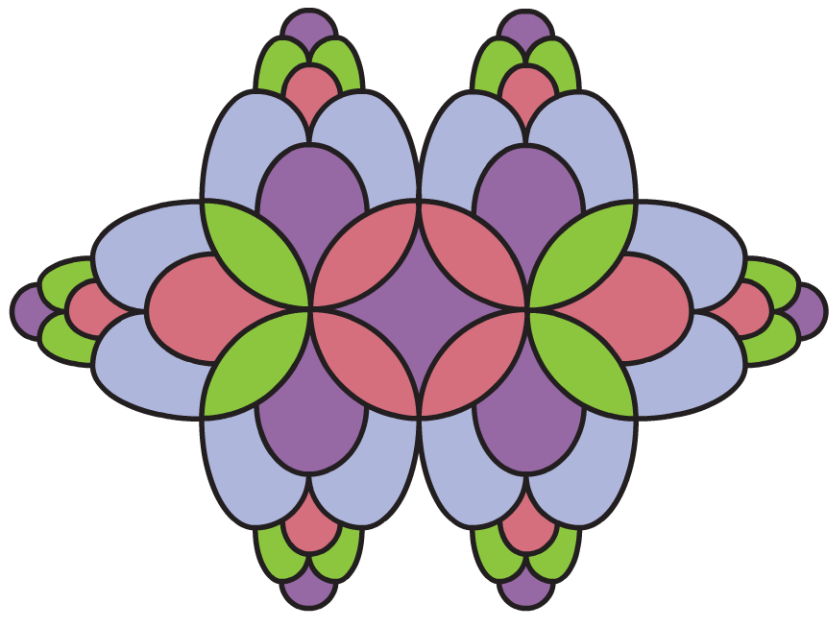

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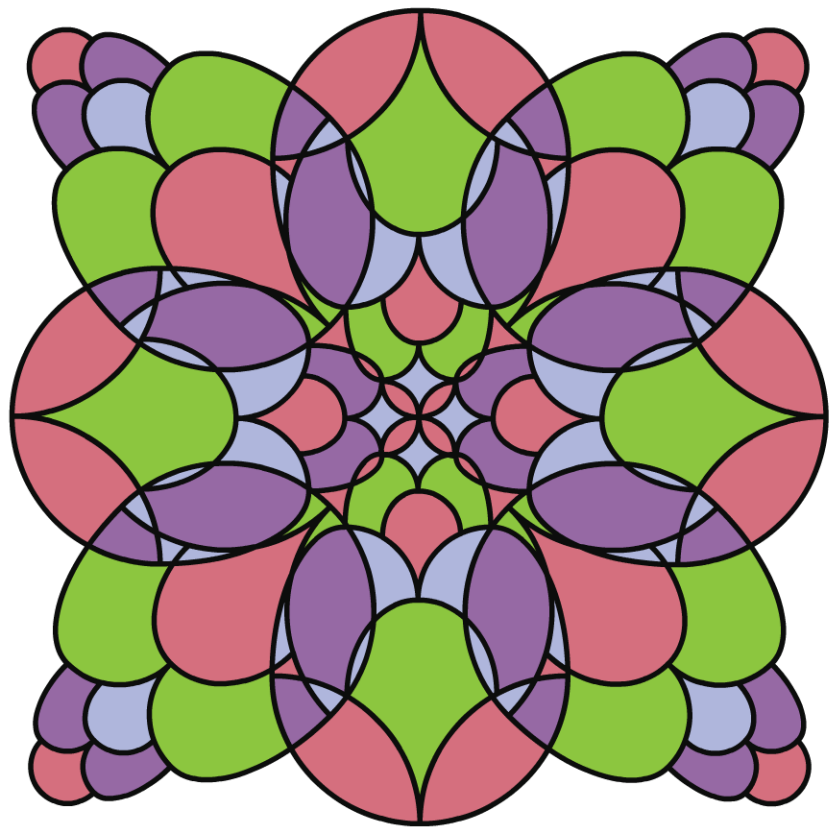

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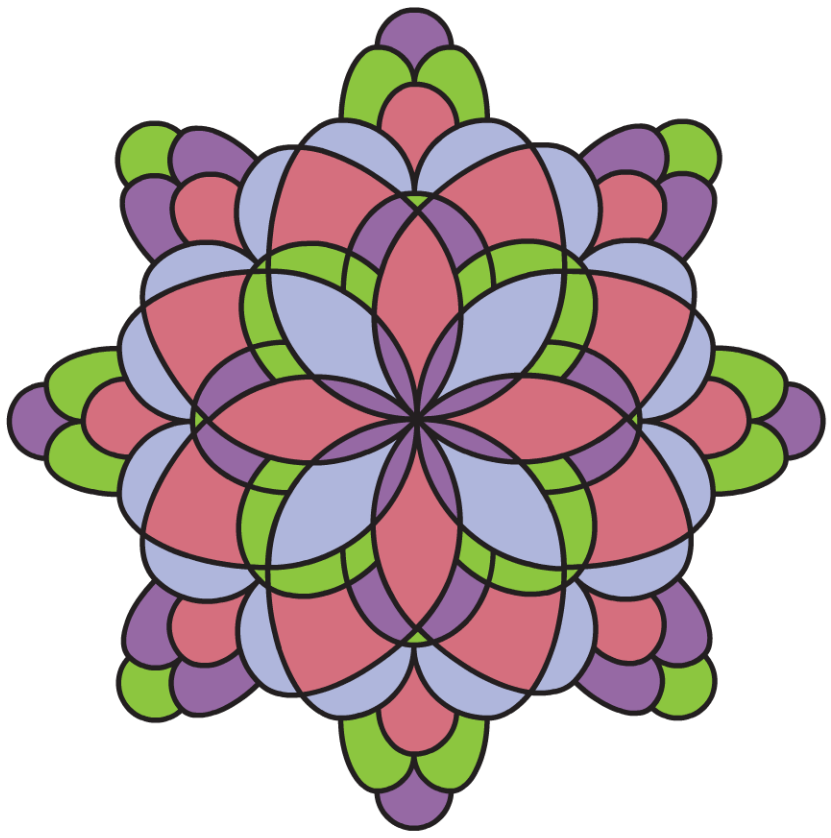

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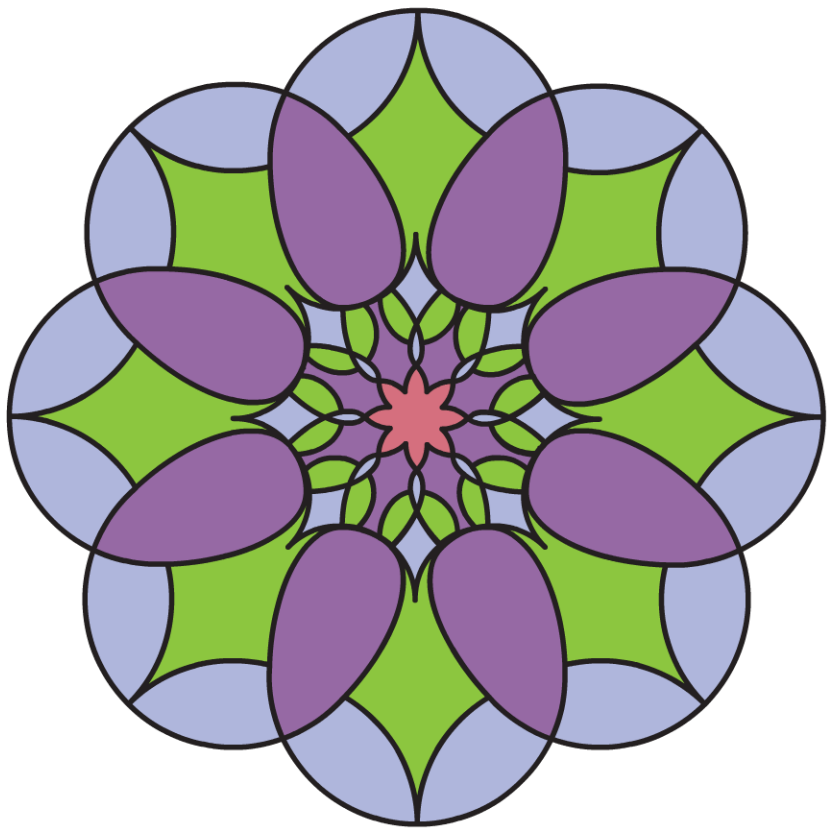

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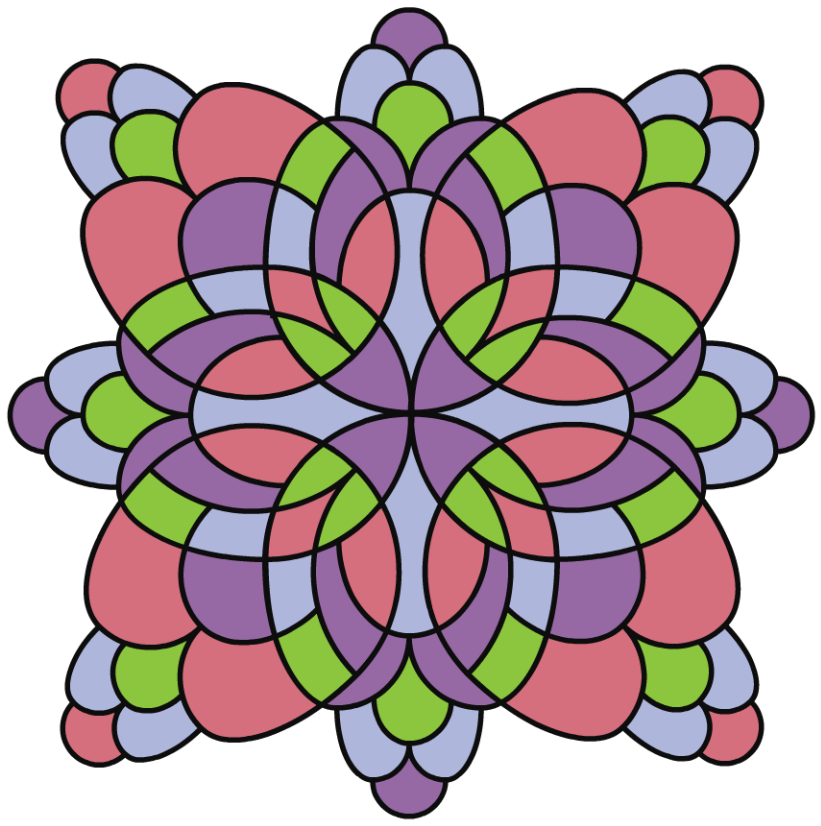
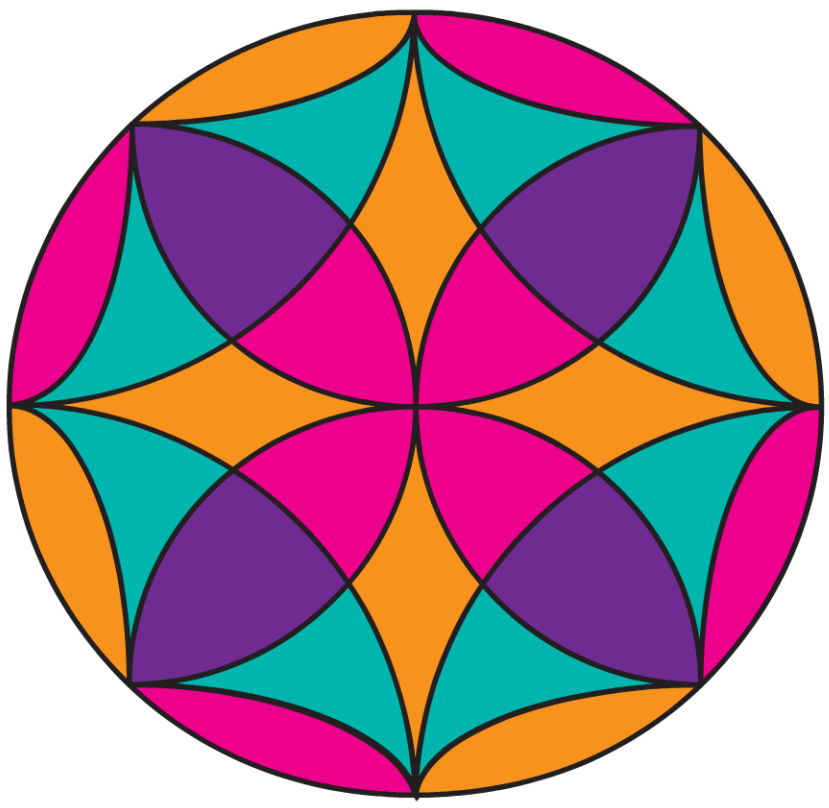


424

Filled Arcs



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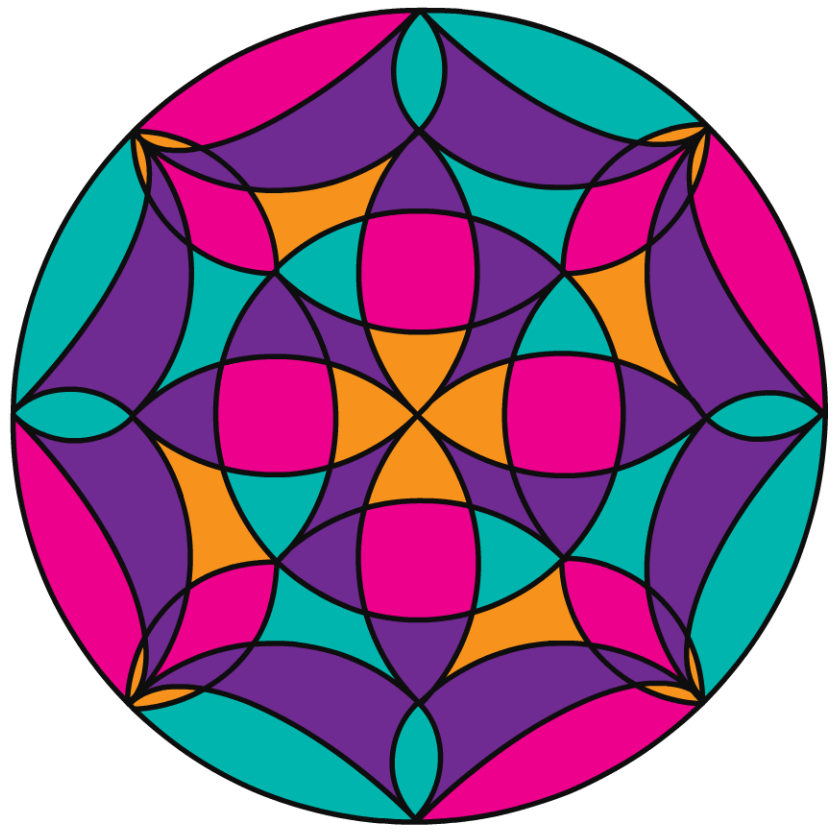

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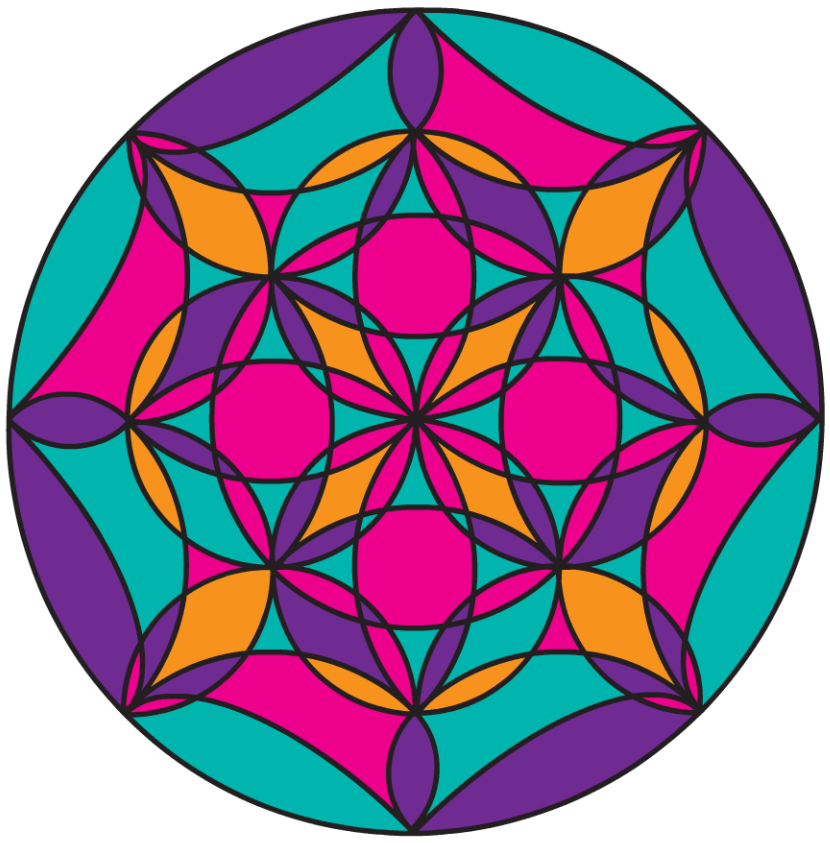

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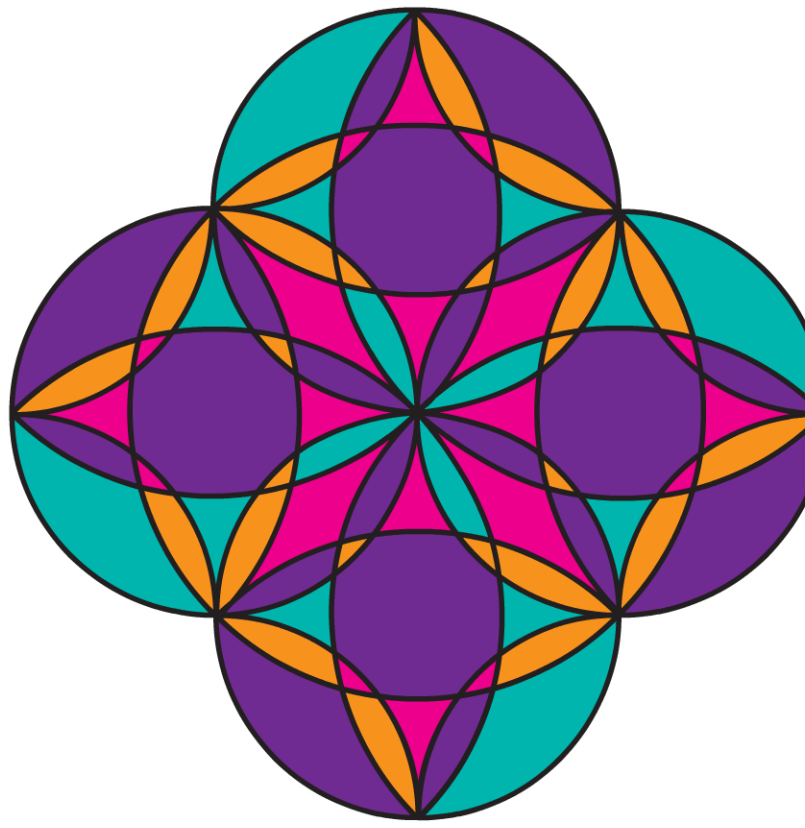

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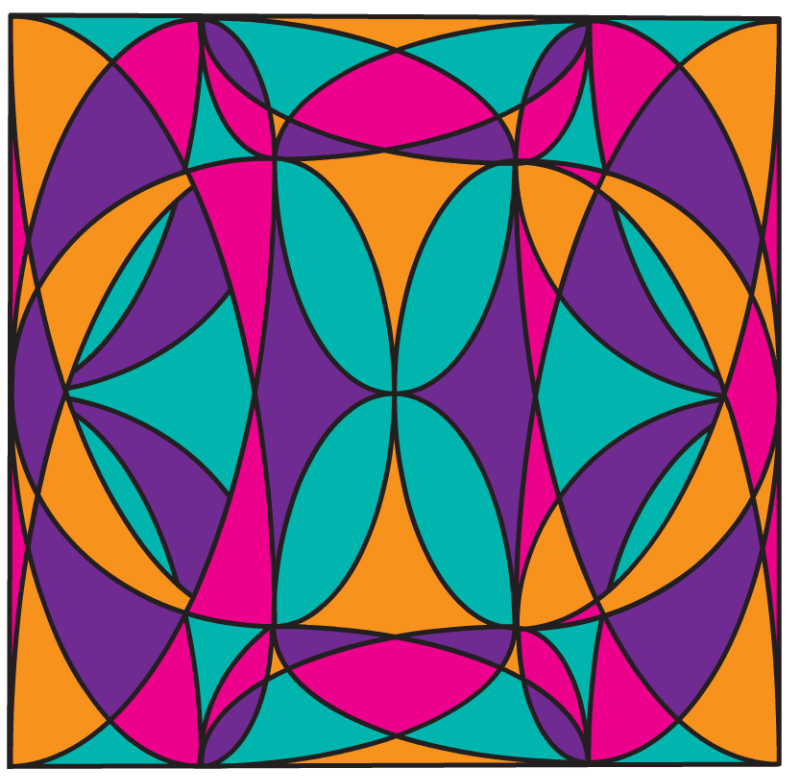

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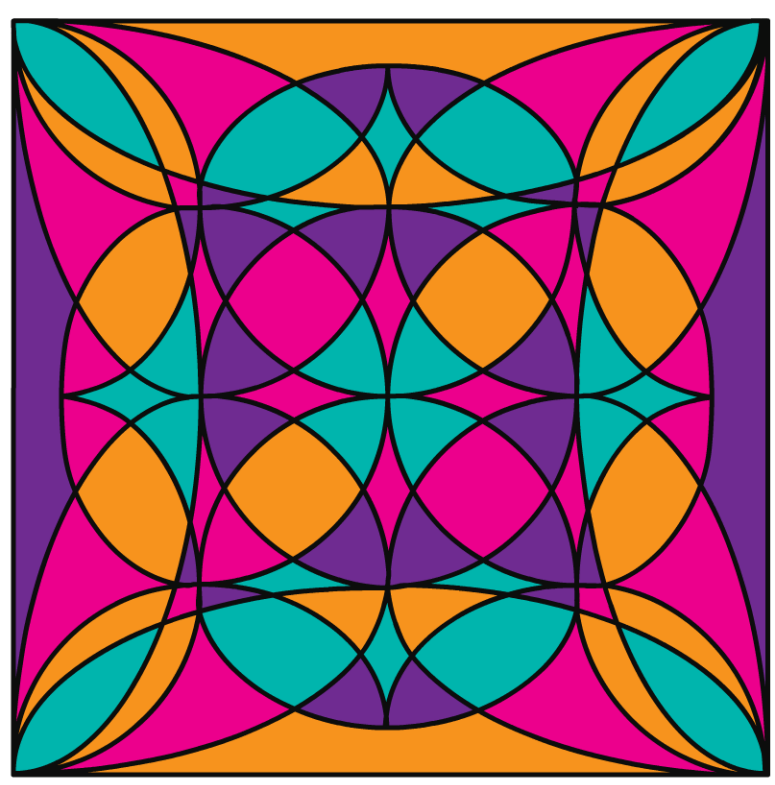

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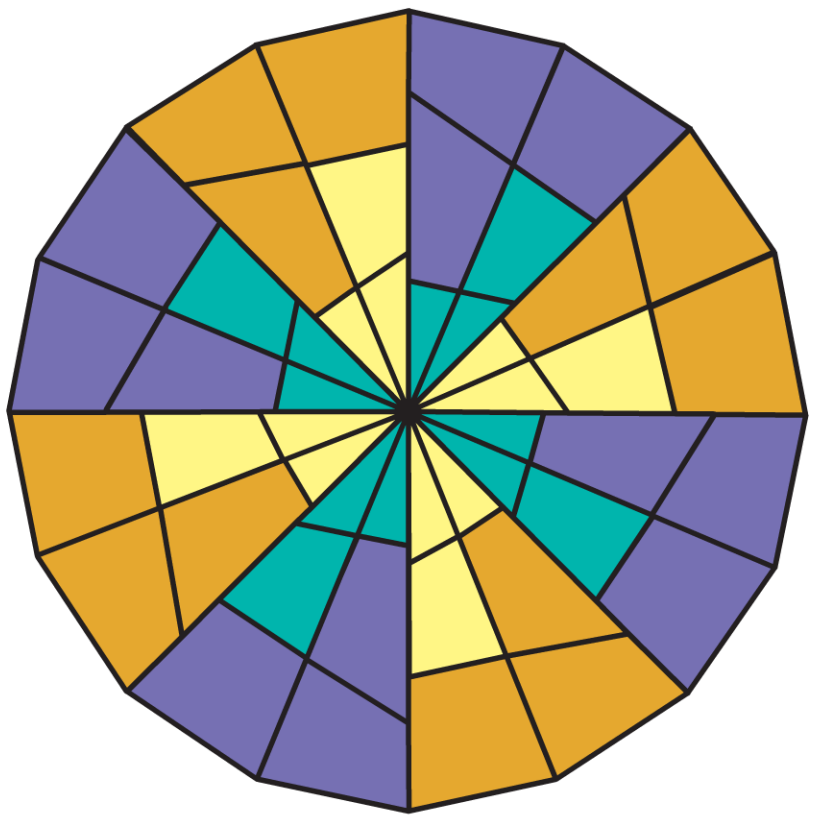
Fractures



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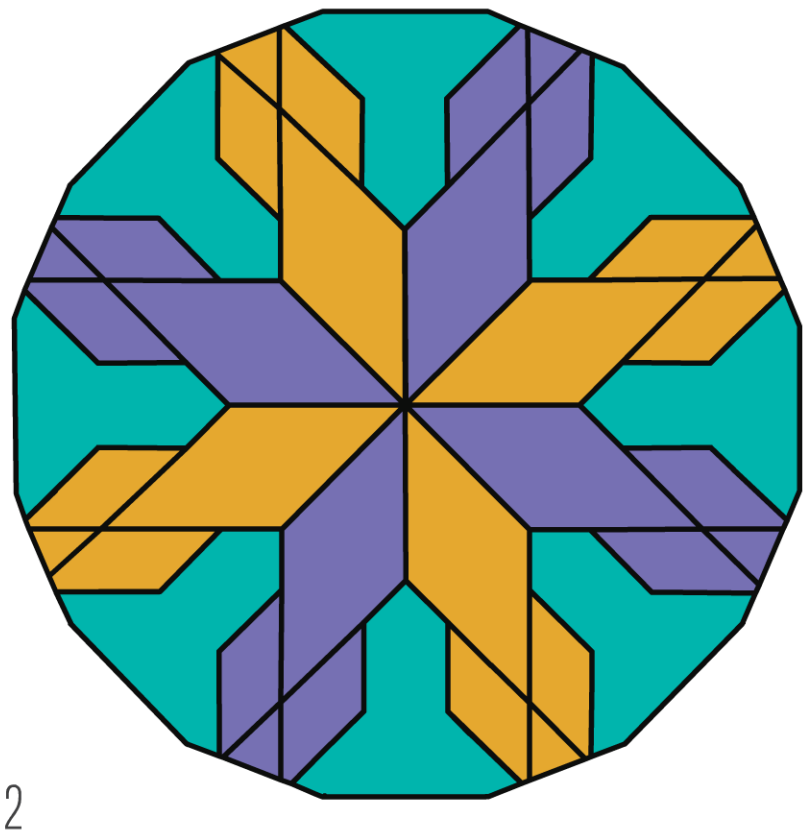

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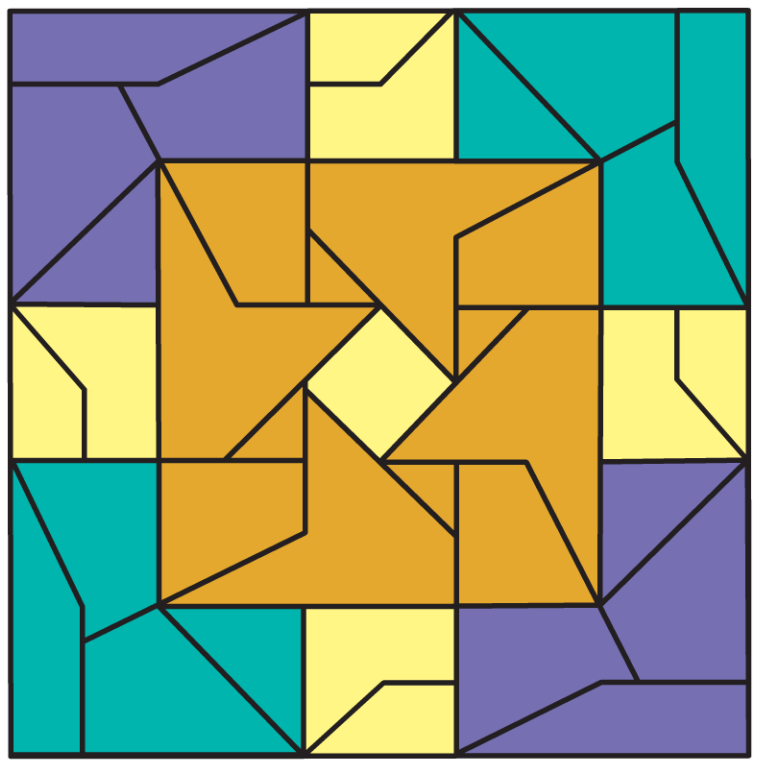

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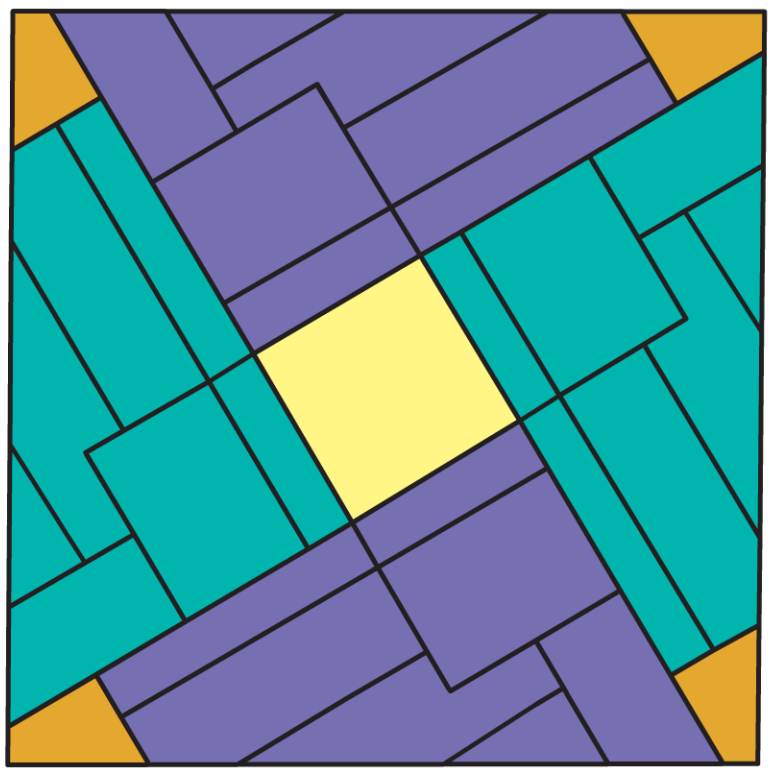

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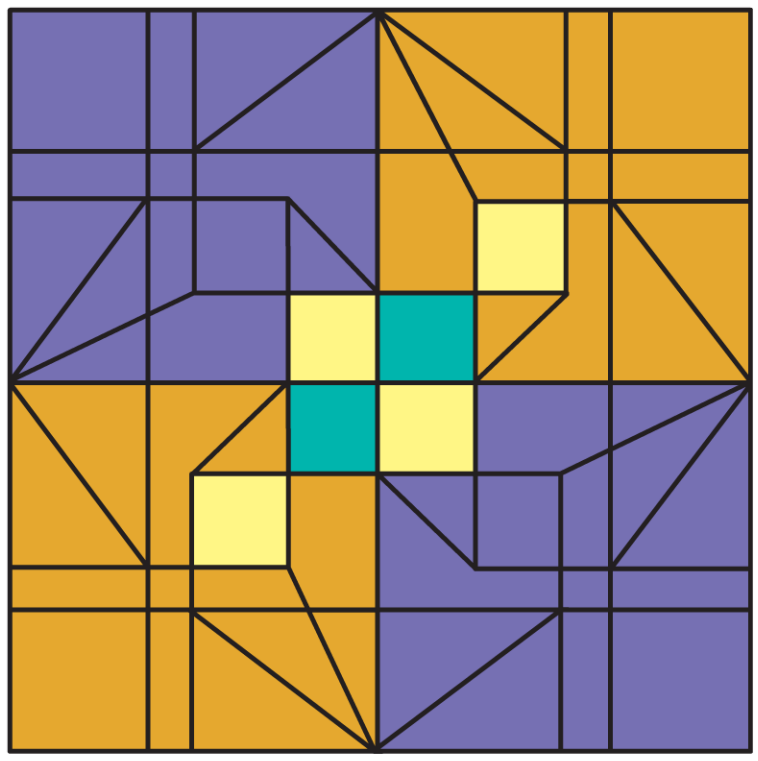

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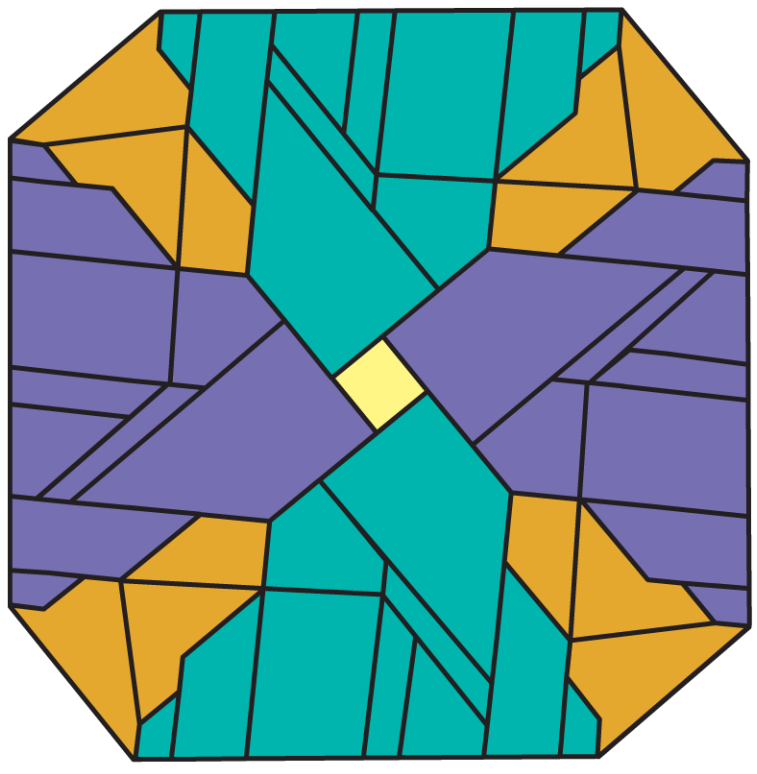

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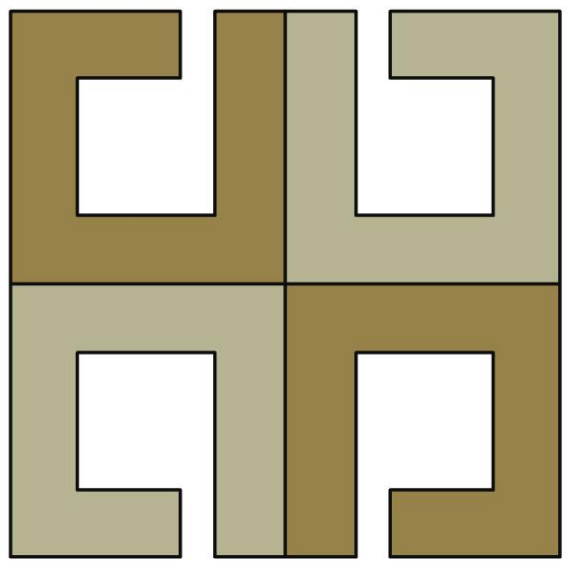
Fret Patterns



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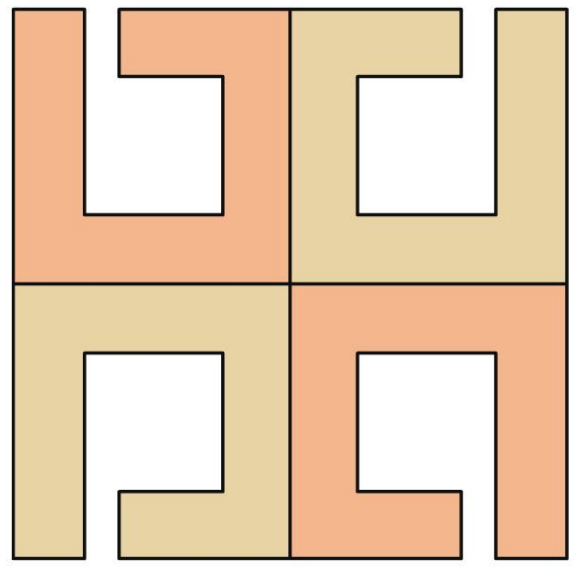

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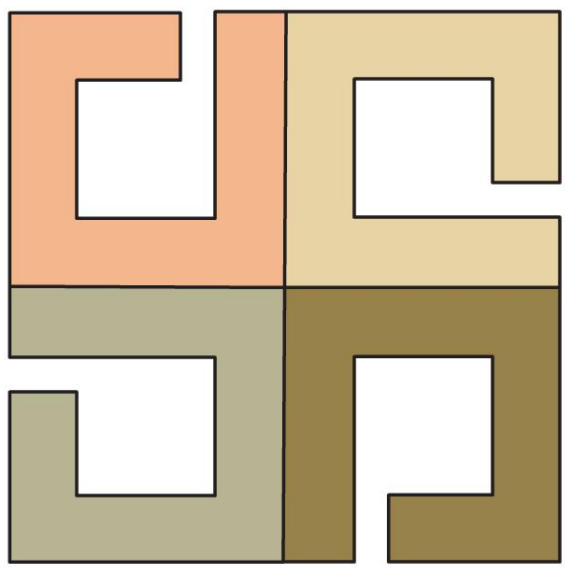

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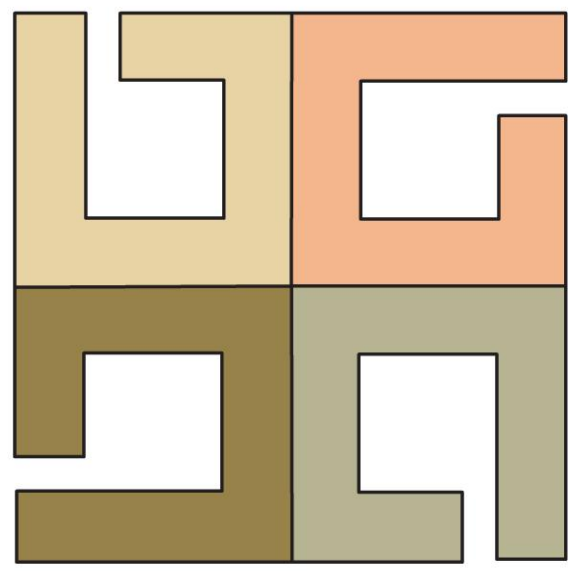

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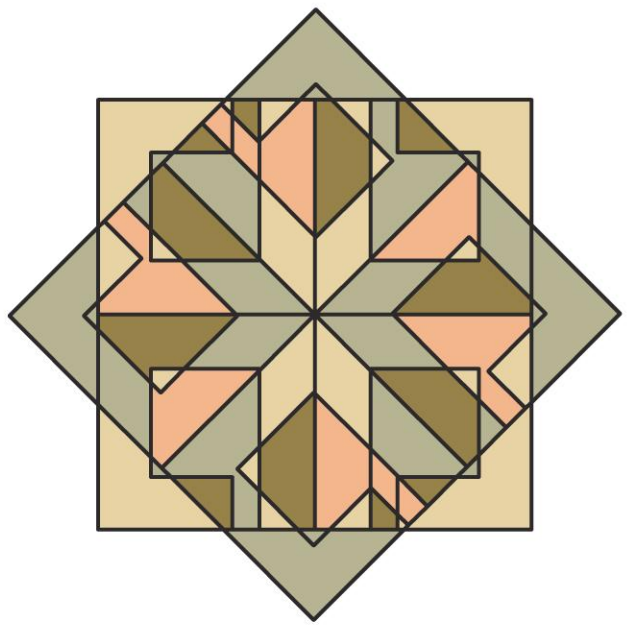

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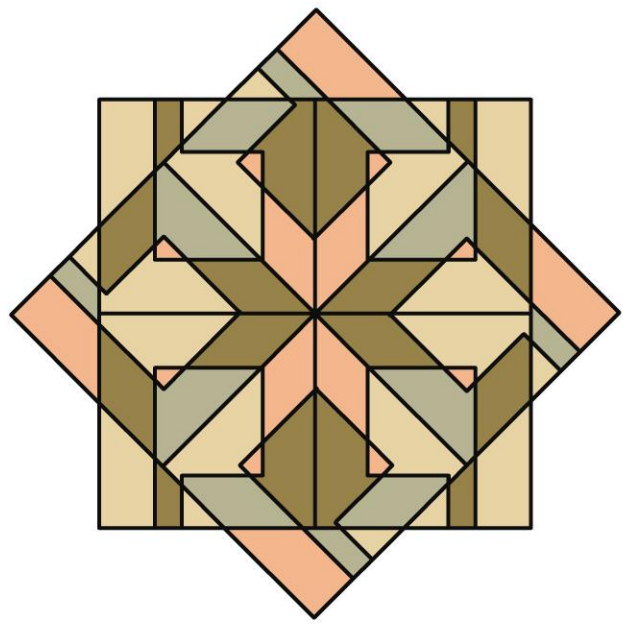

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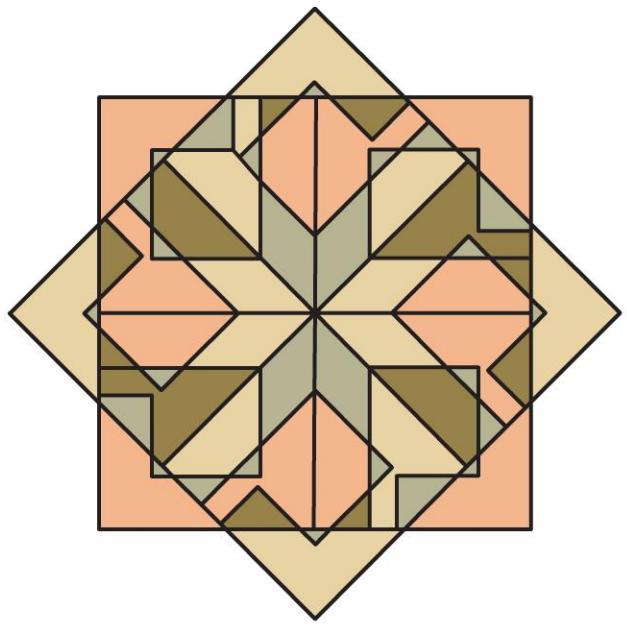

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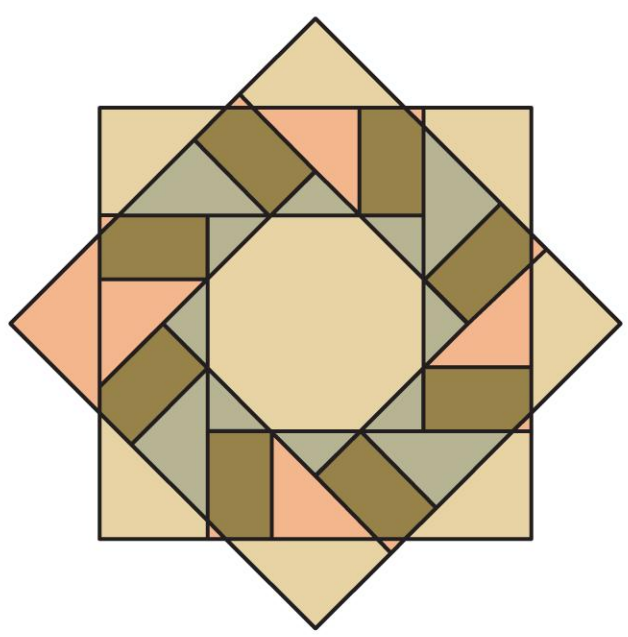

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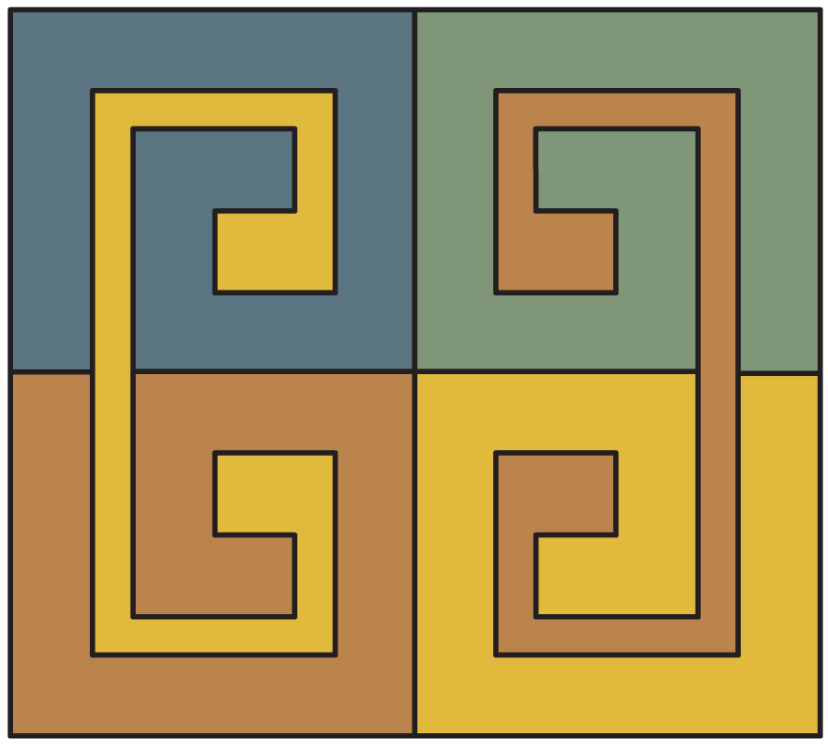
Fret Patterns 2



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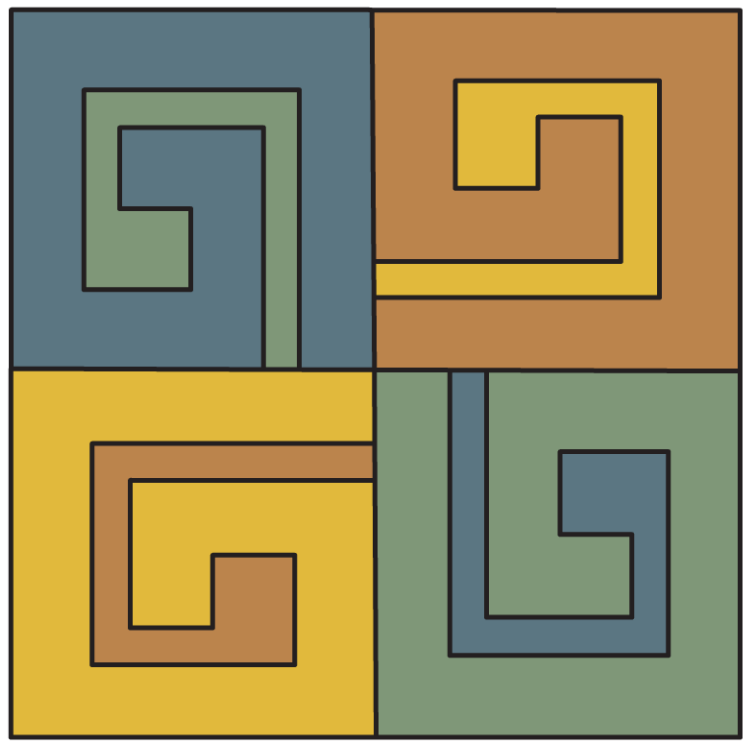

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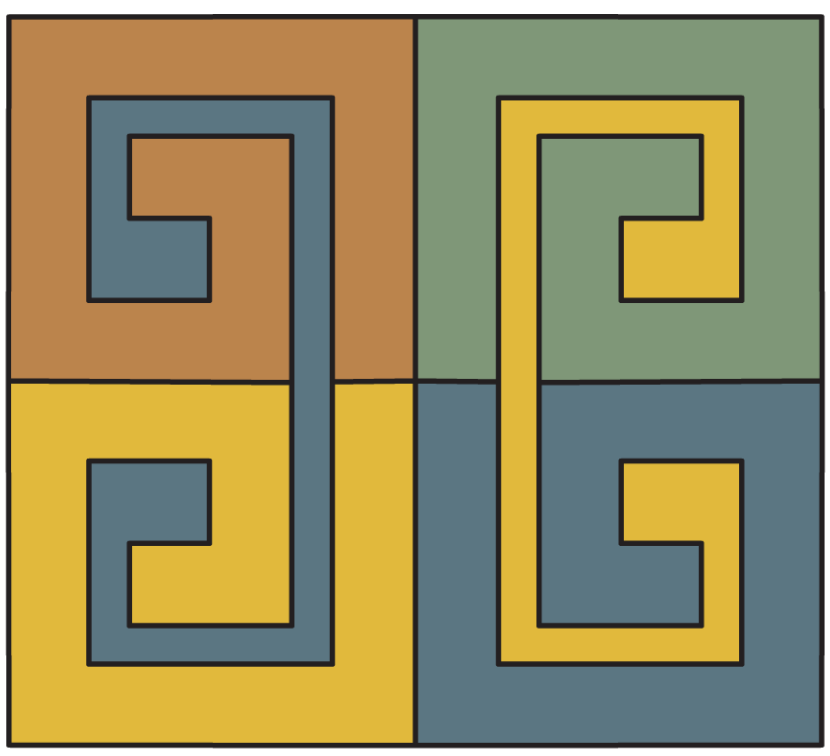

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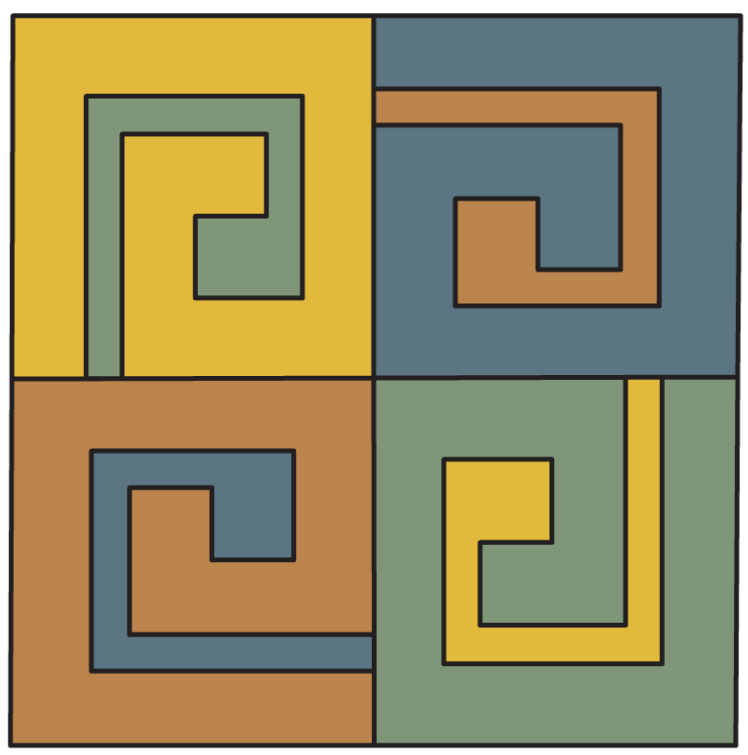

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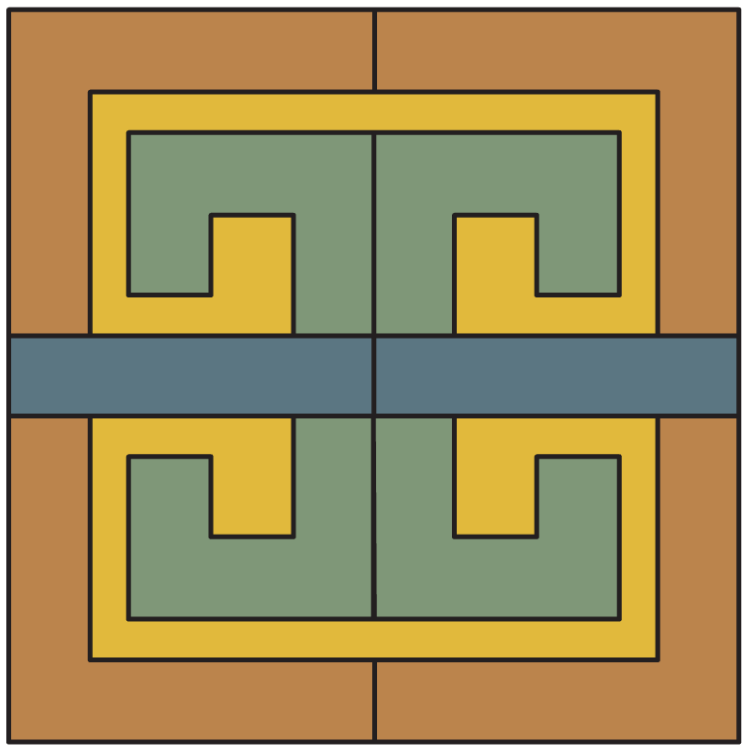
Fret Patterns 2



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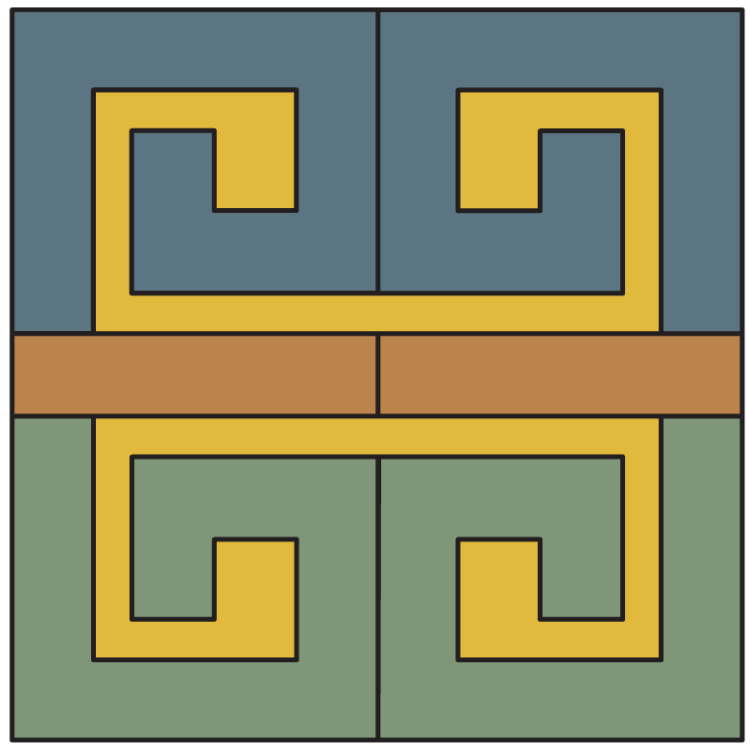

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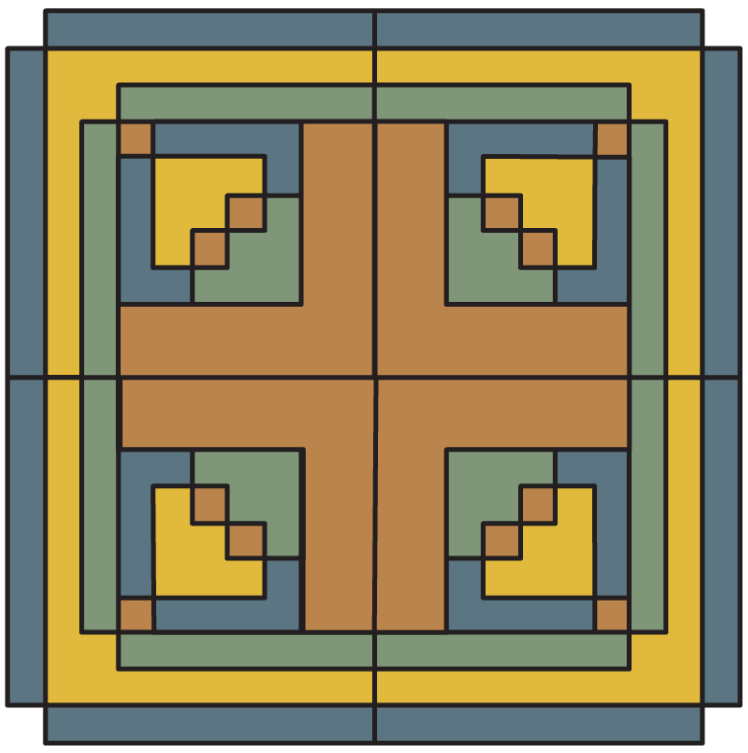

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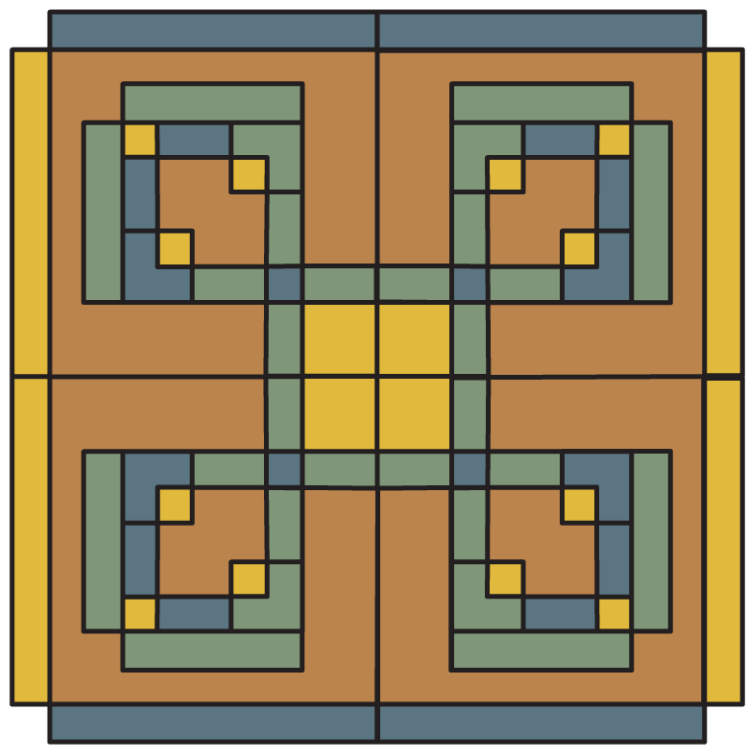

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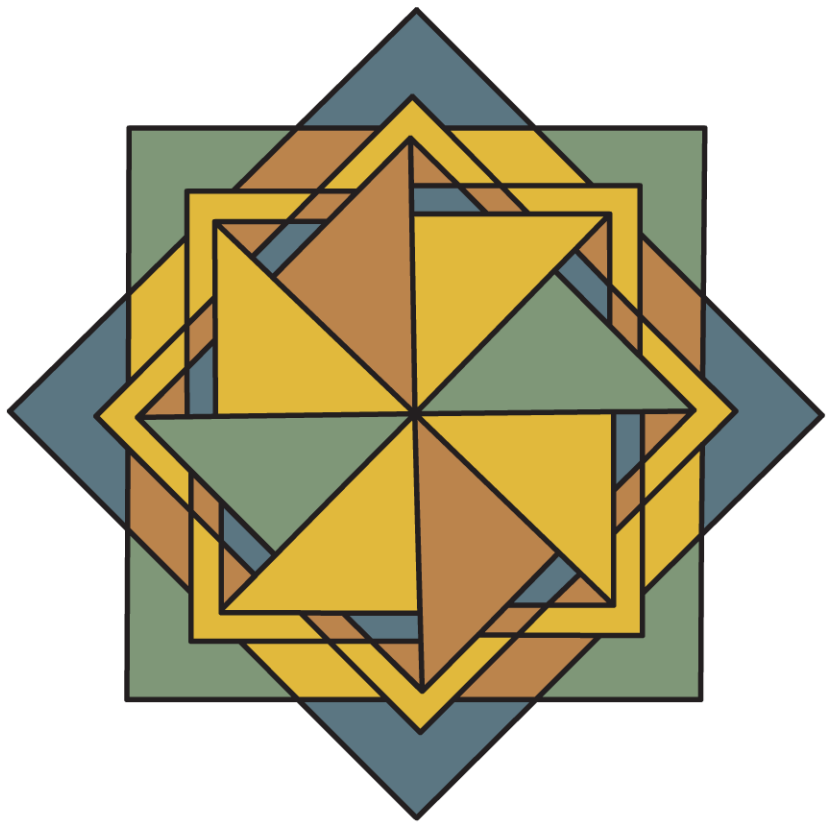

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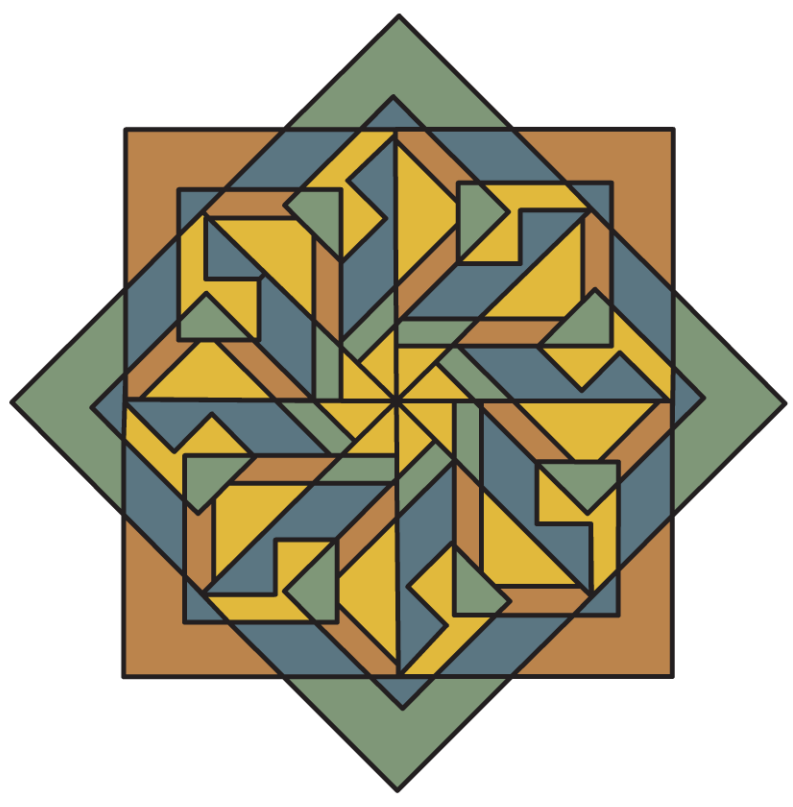

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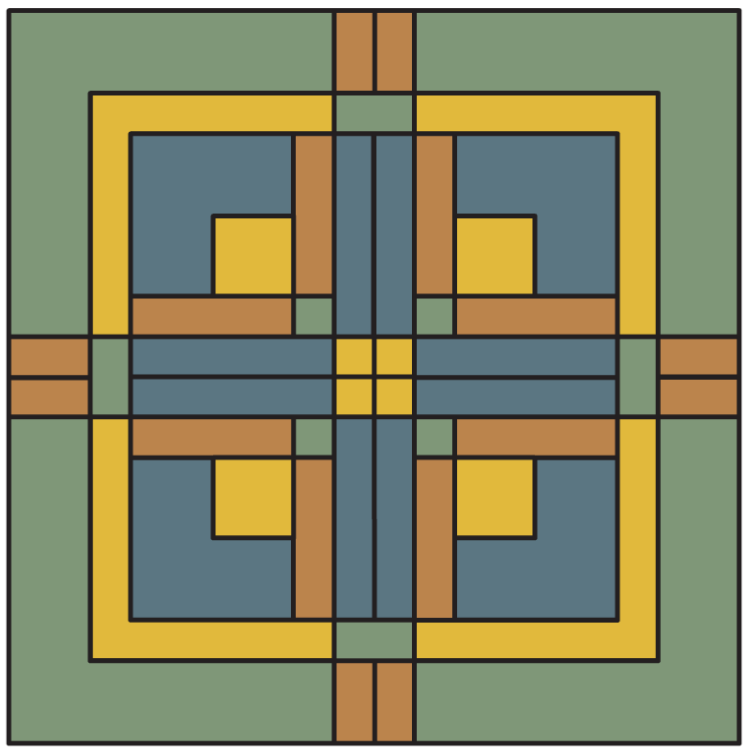

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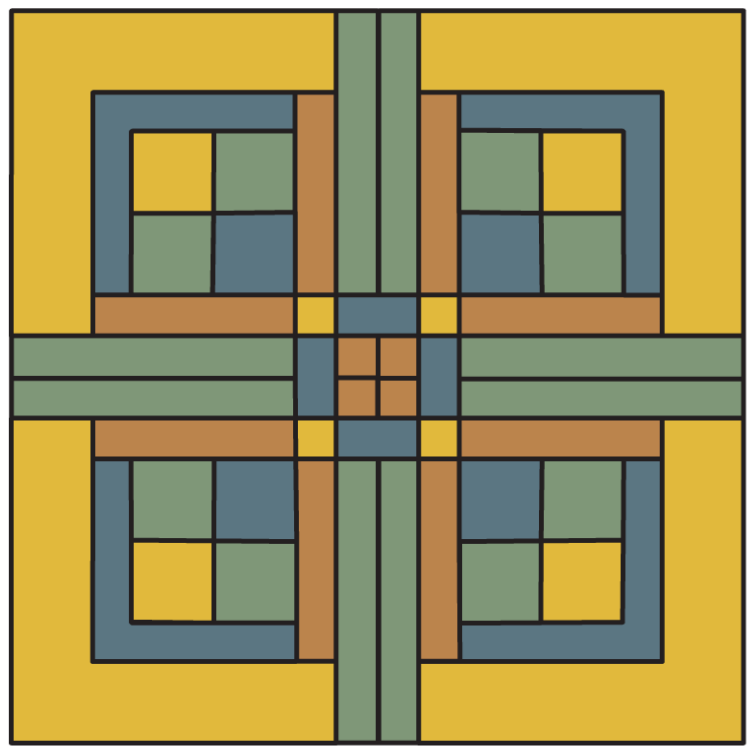

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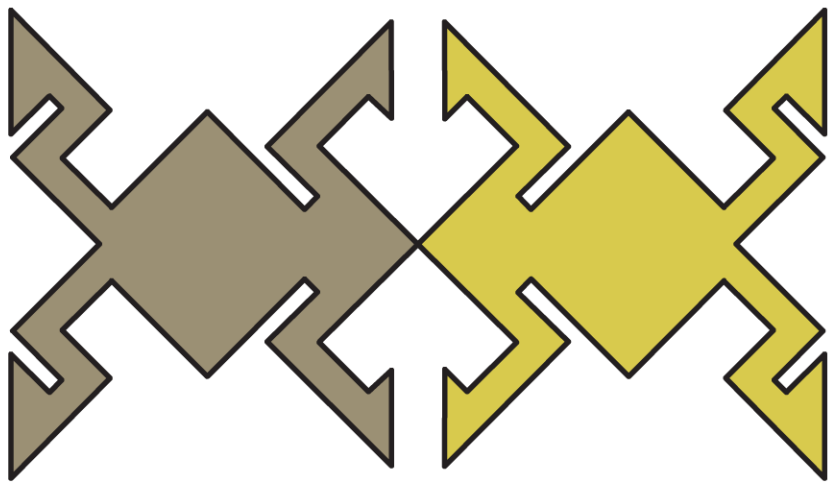
Frogs



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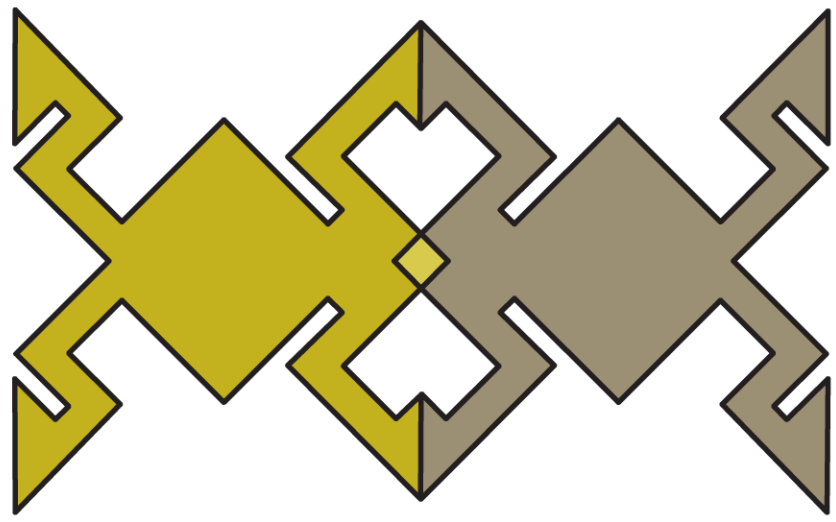

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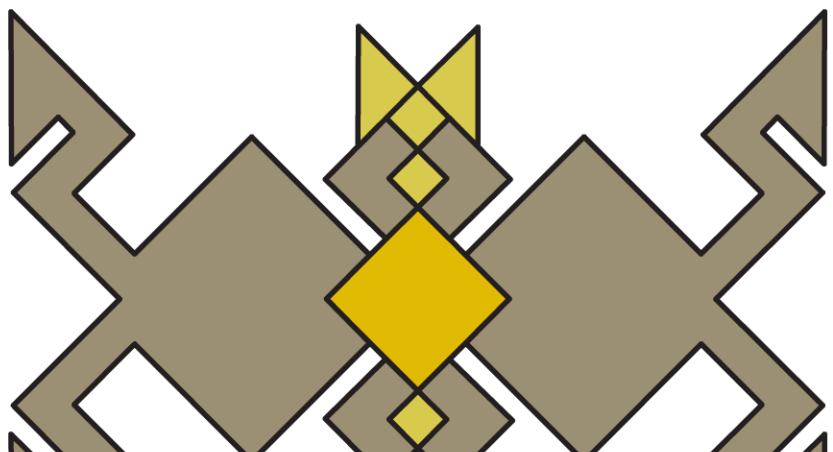

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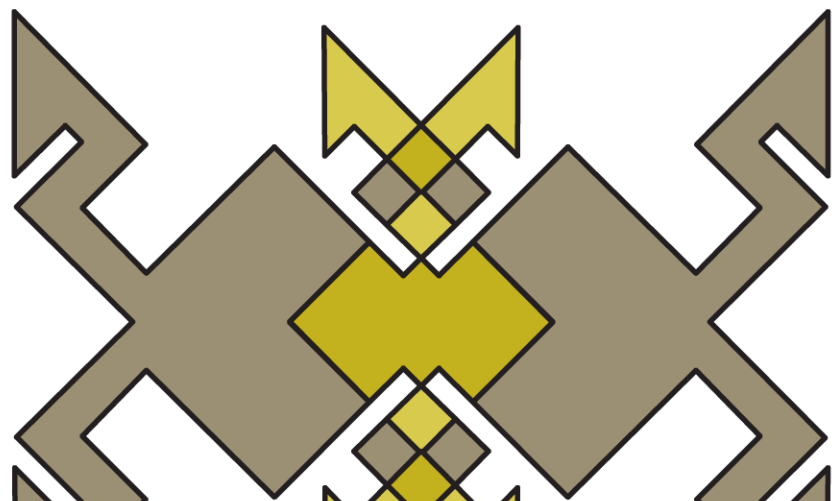

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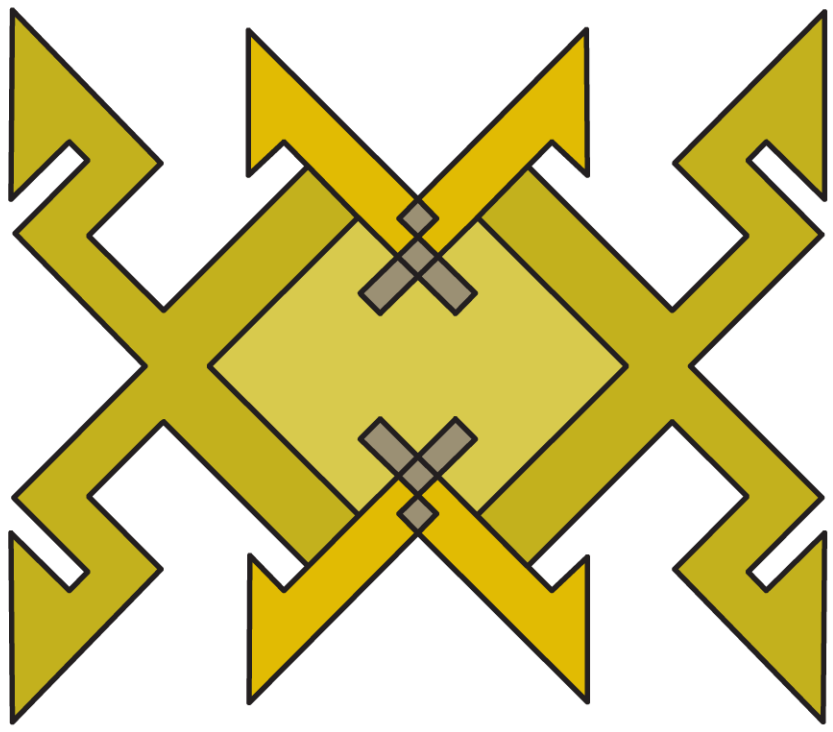

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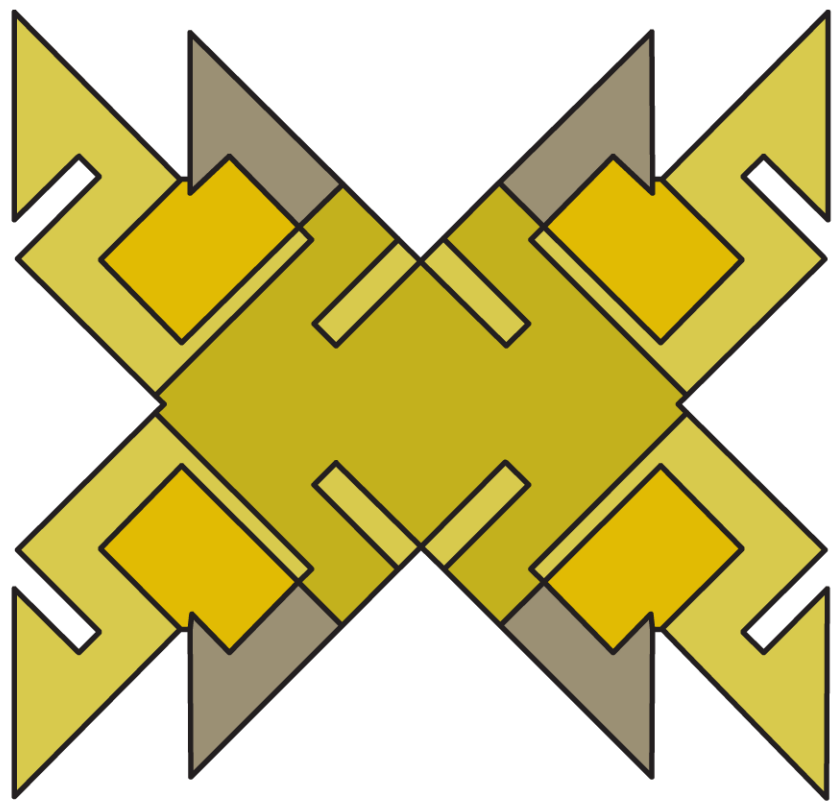

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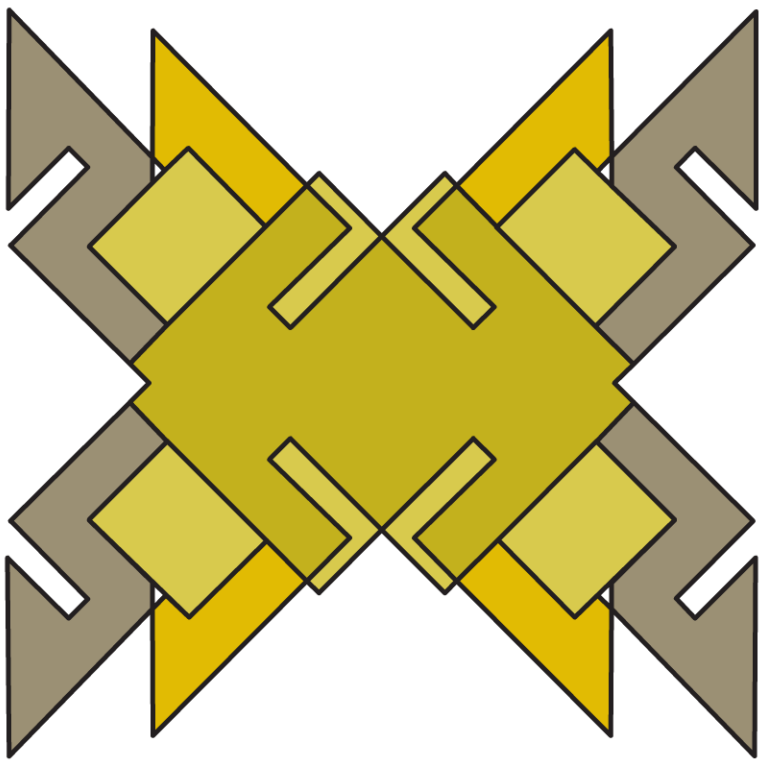

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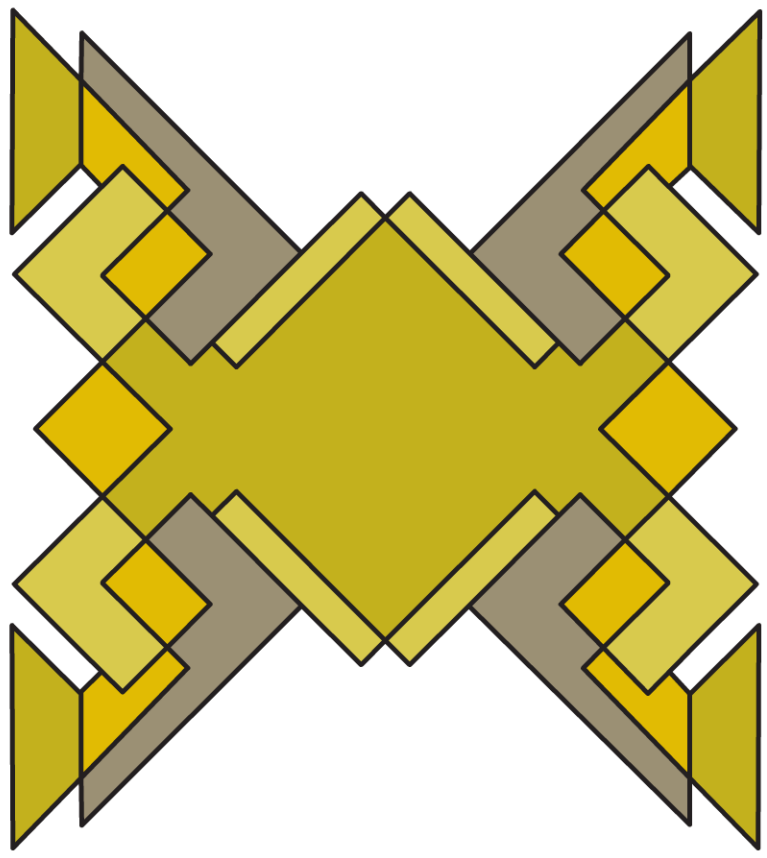

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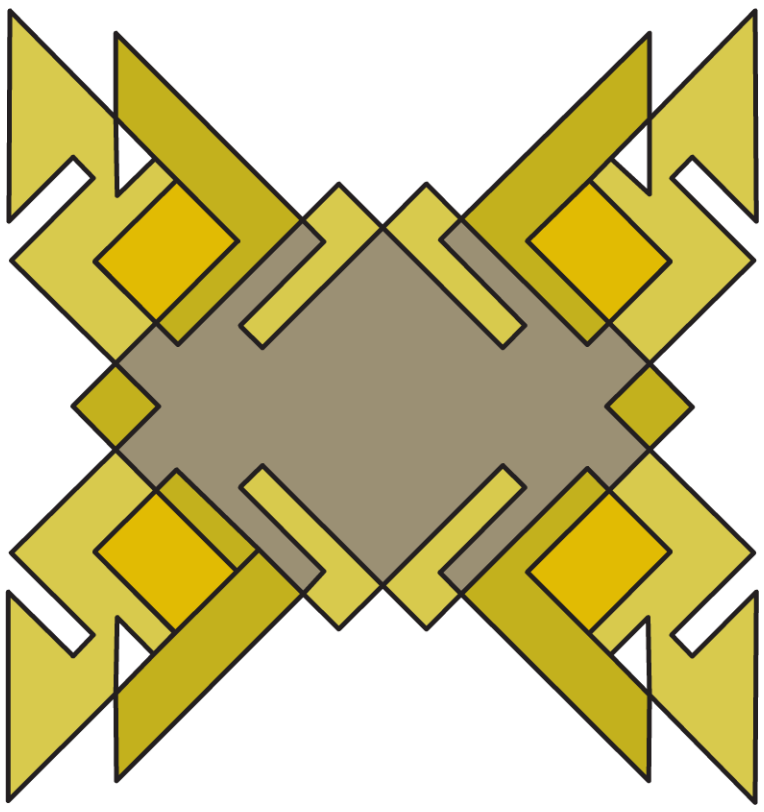

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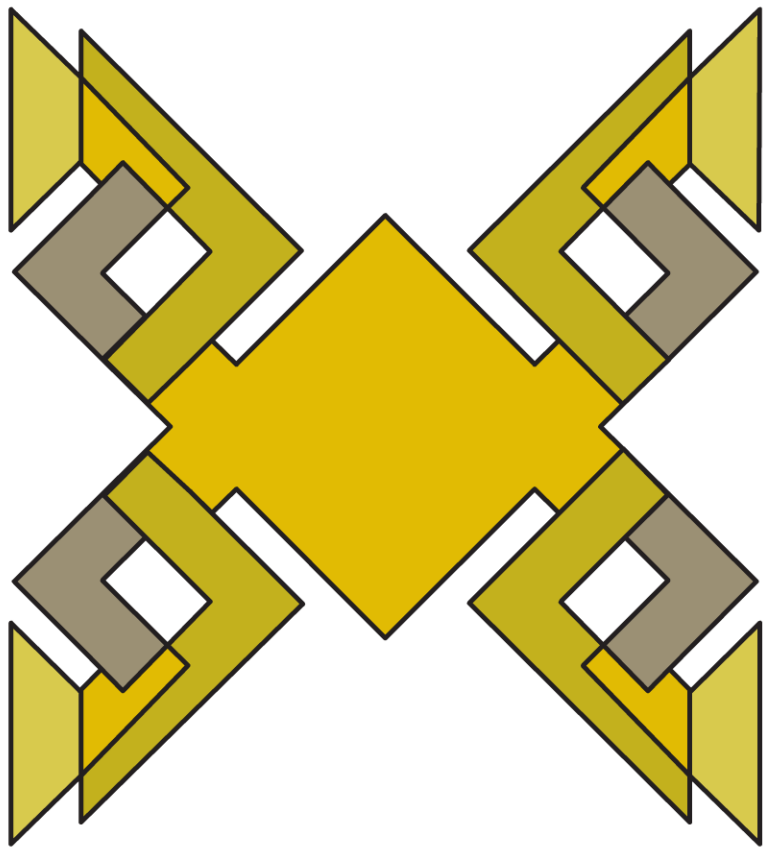

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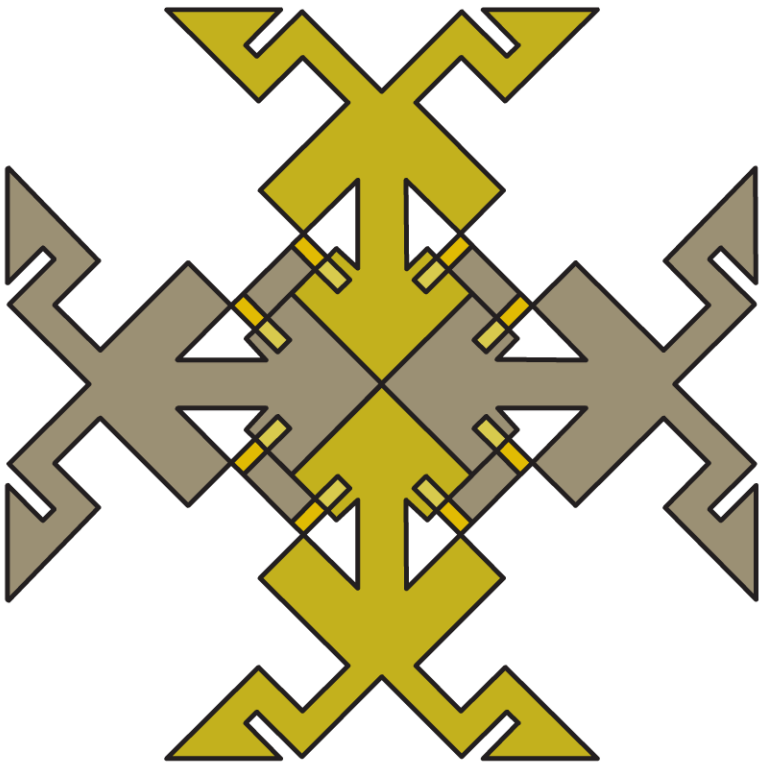

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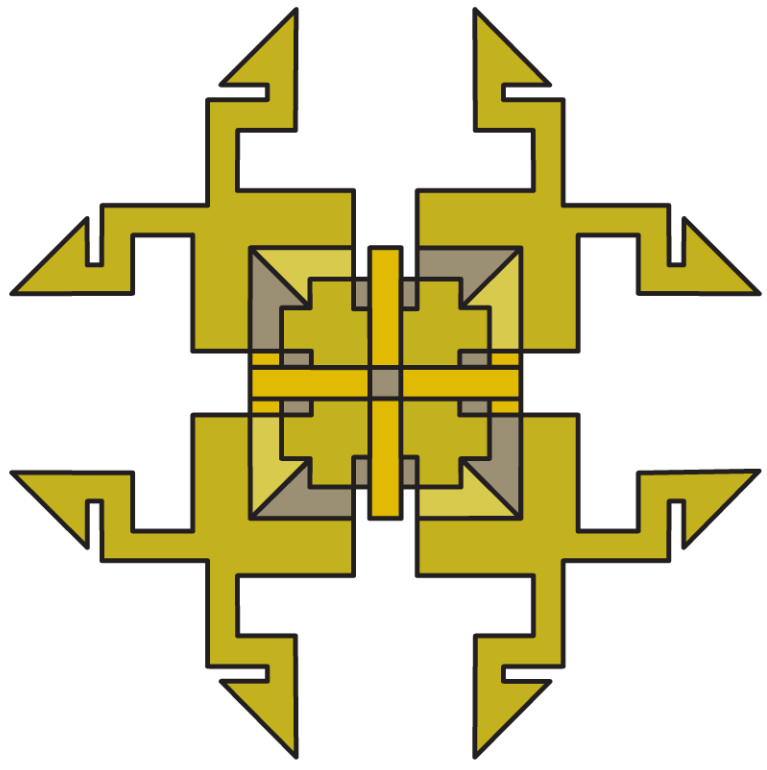

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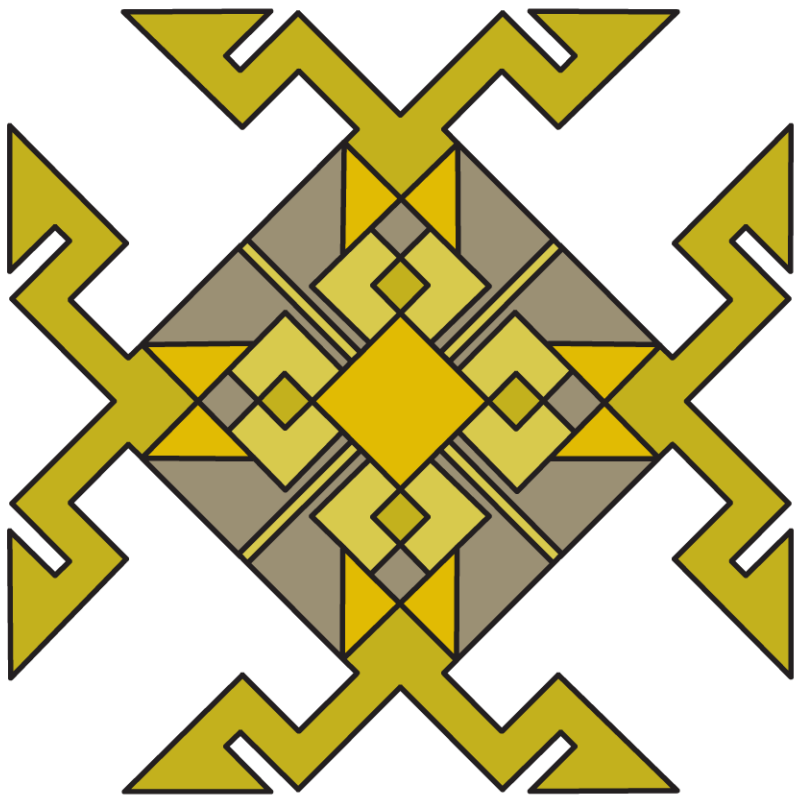
Frogs



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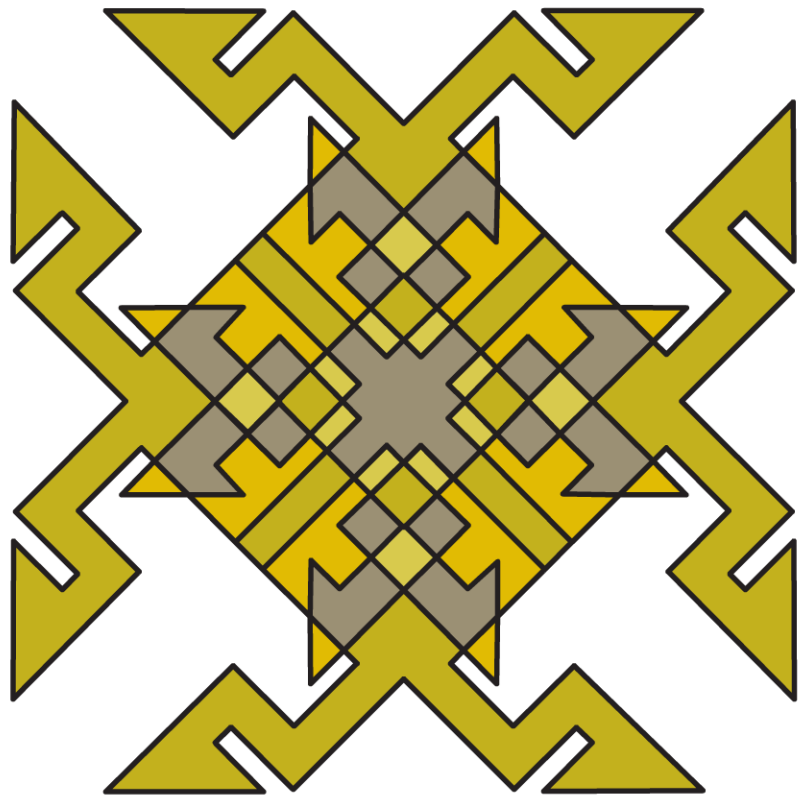

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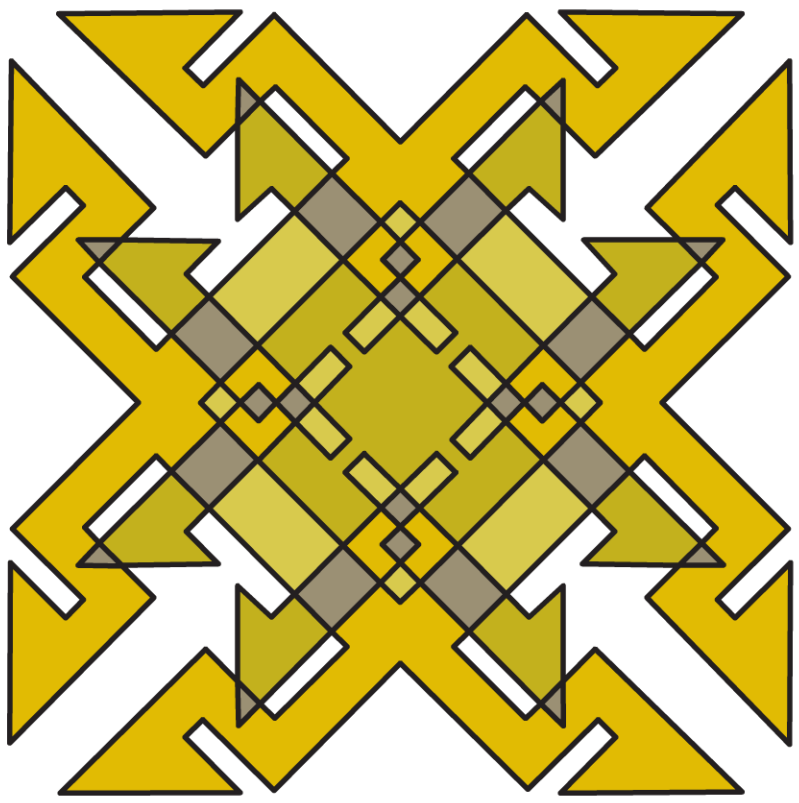

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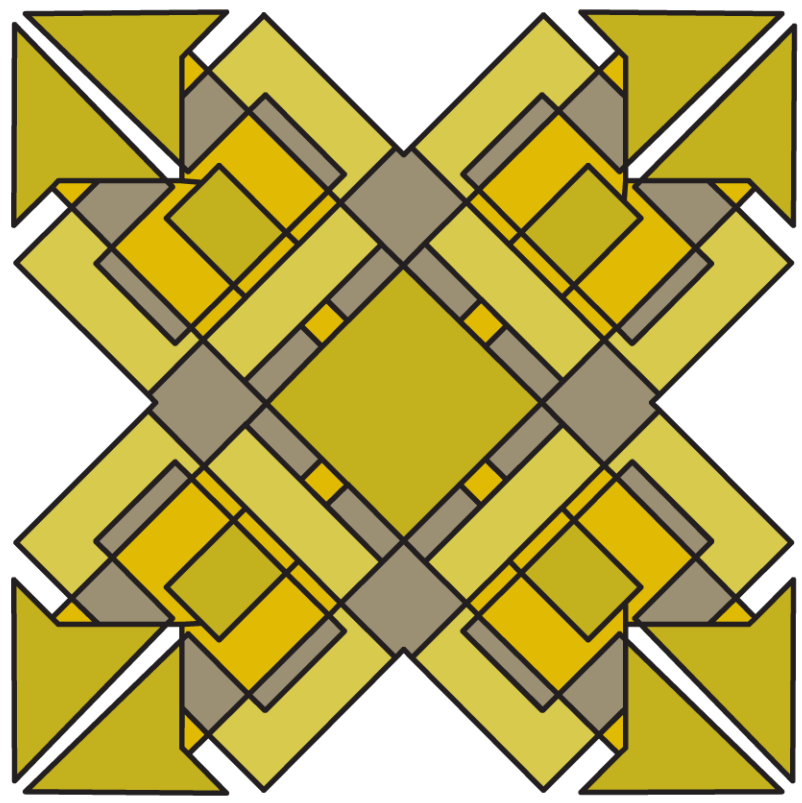

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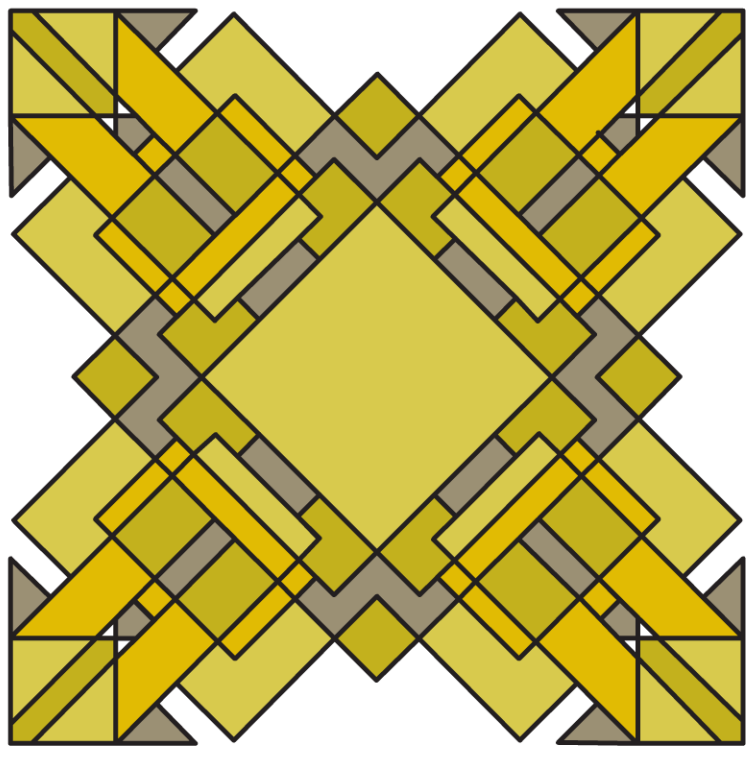

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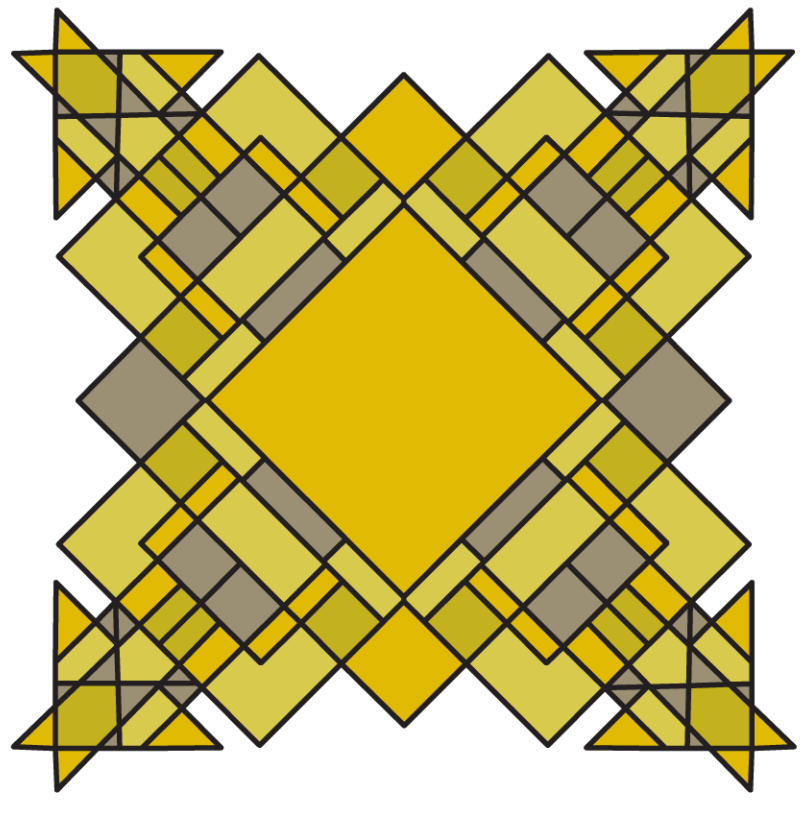

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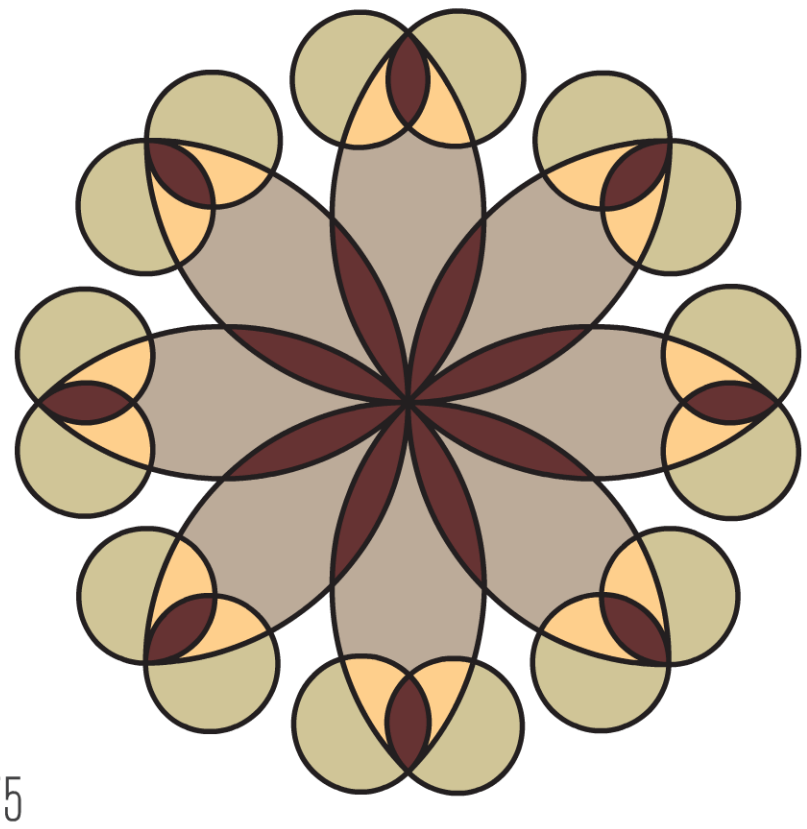
Headphones



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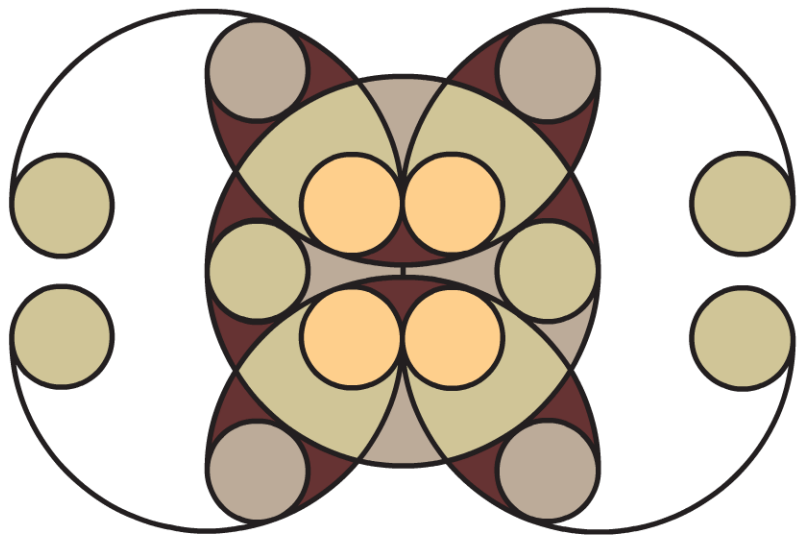

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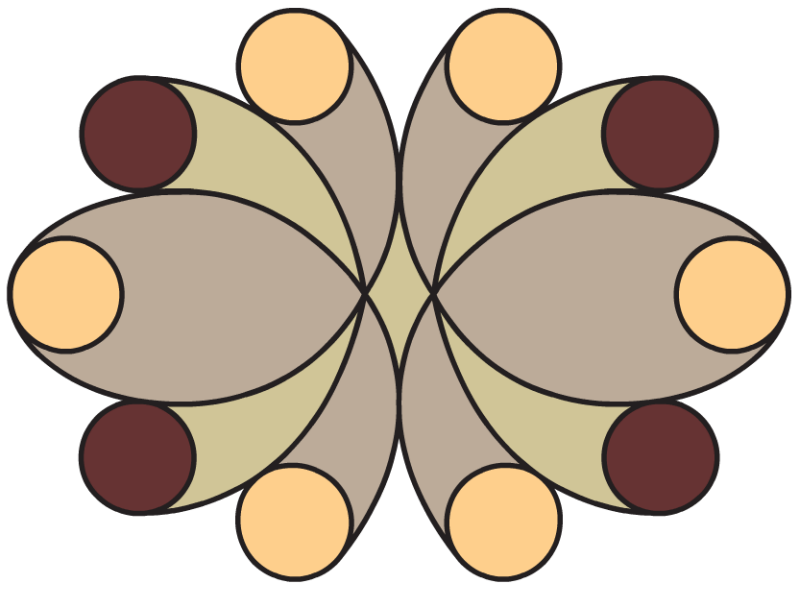

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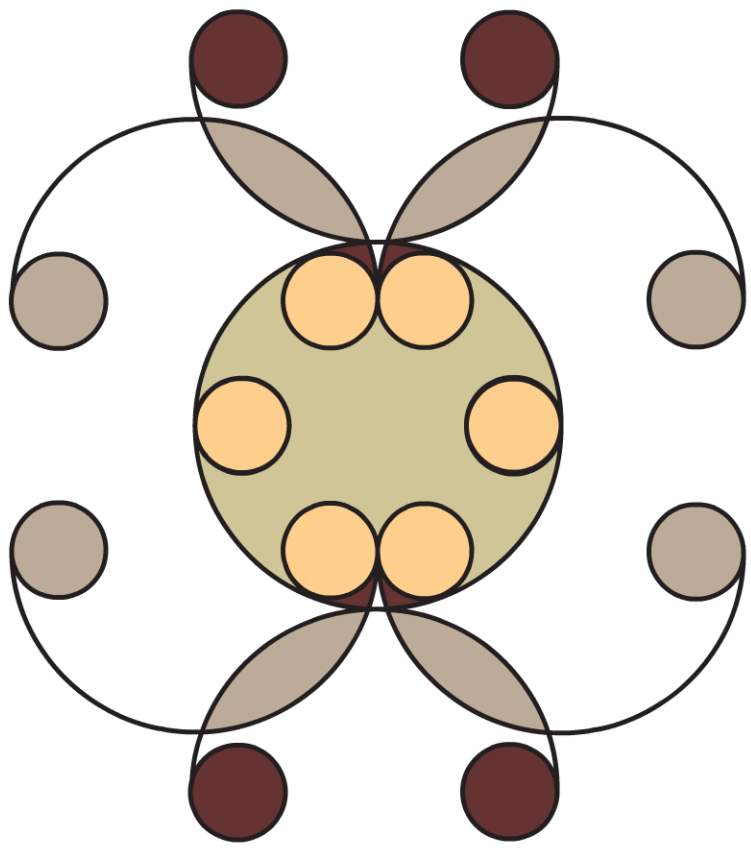

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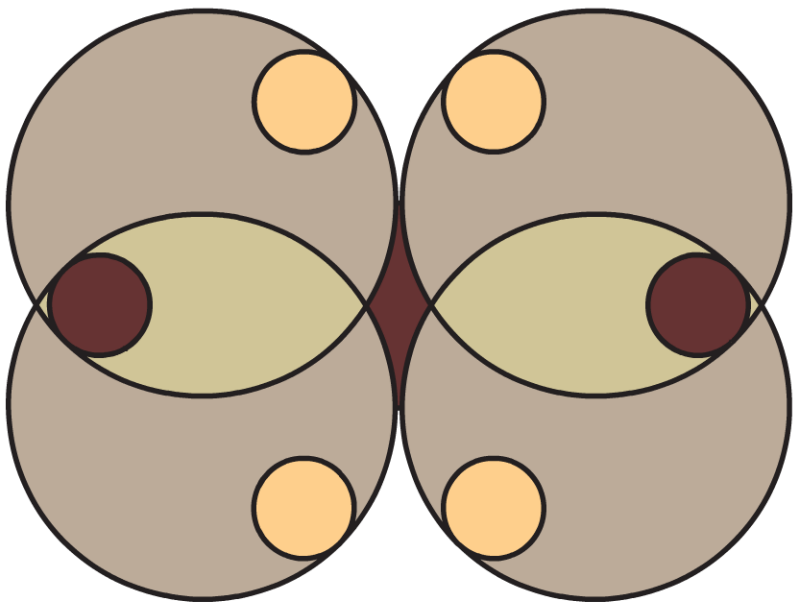

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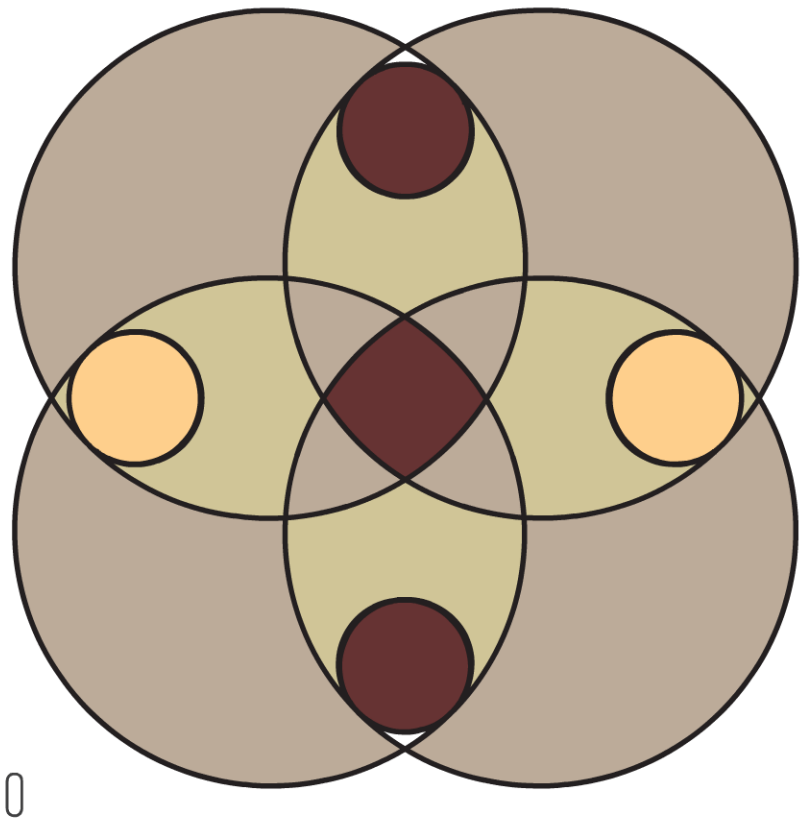

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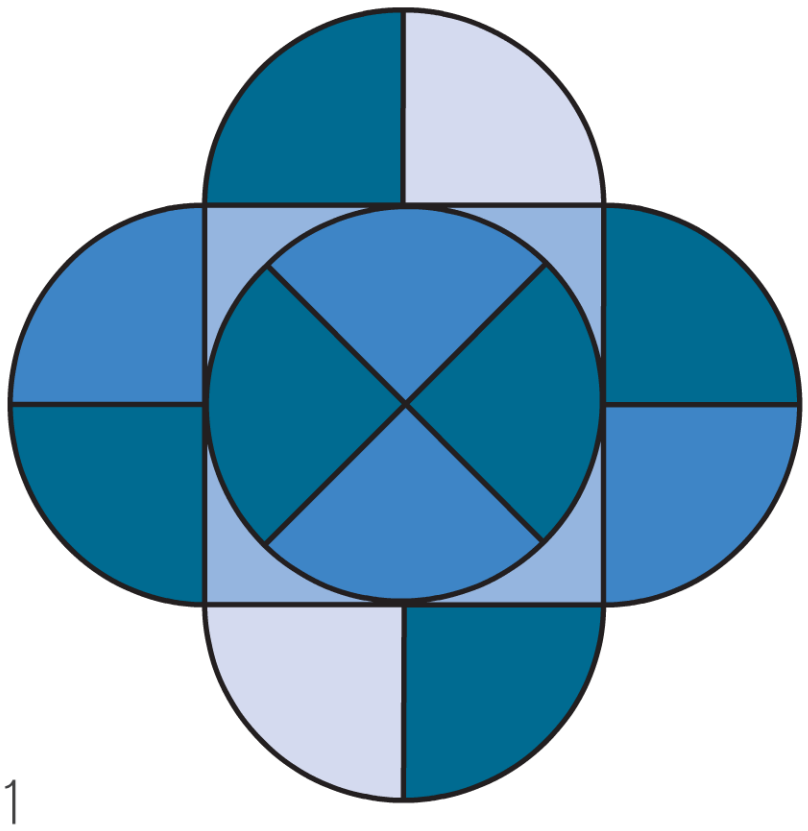
Hemispheres



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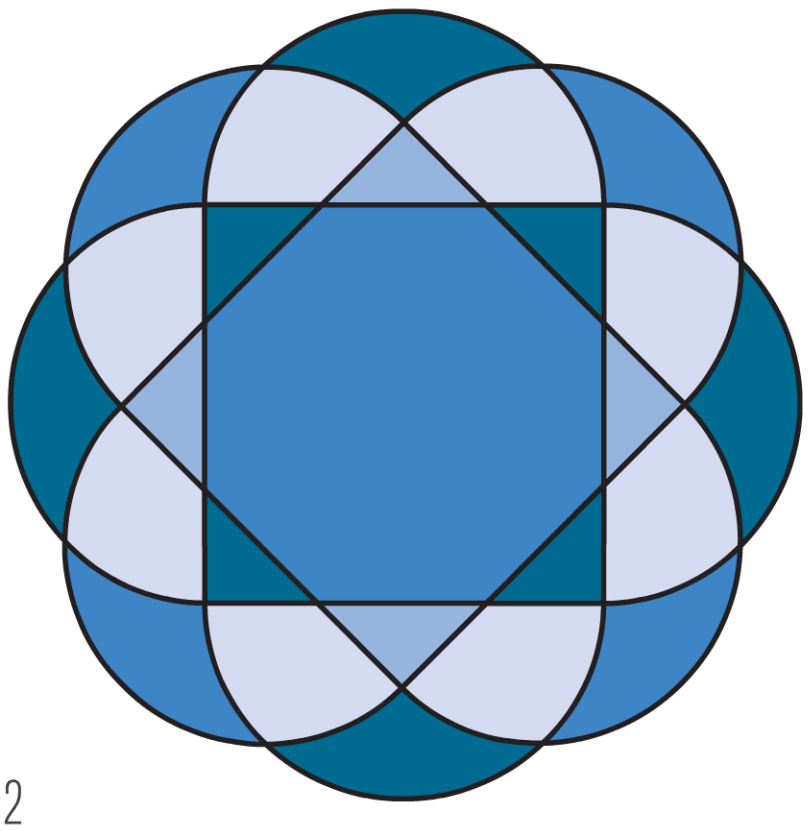

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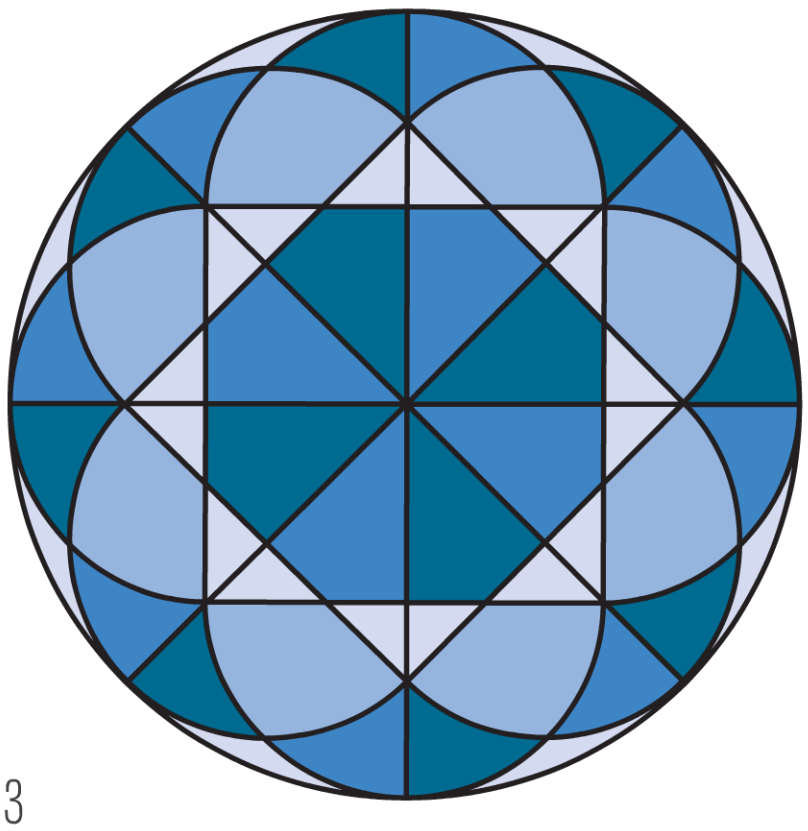

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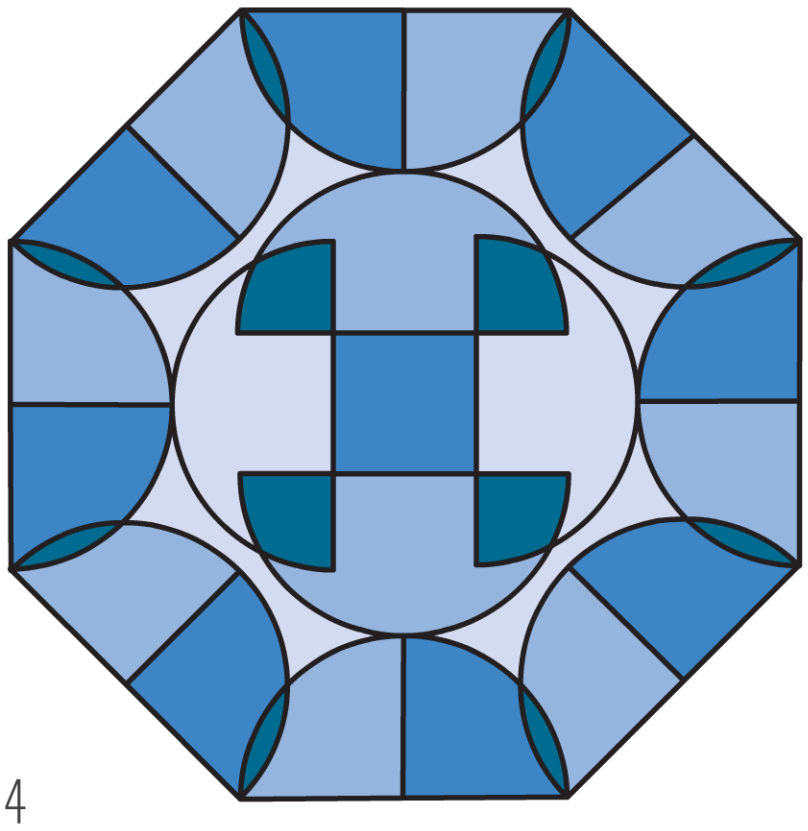

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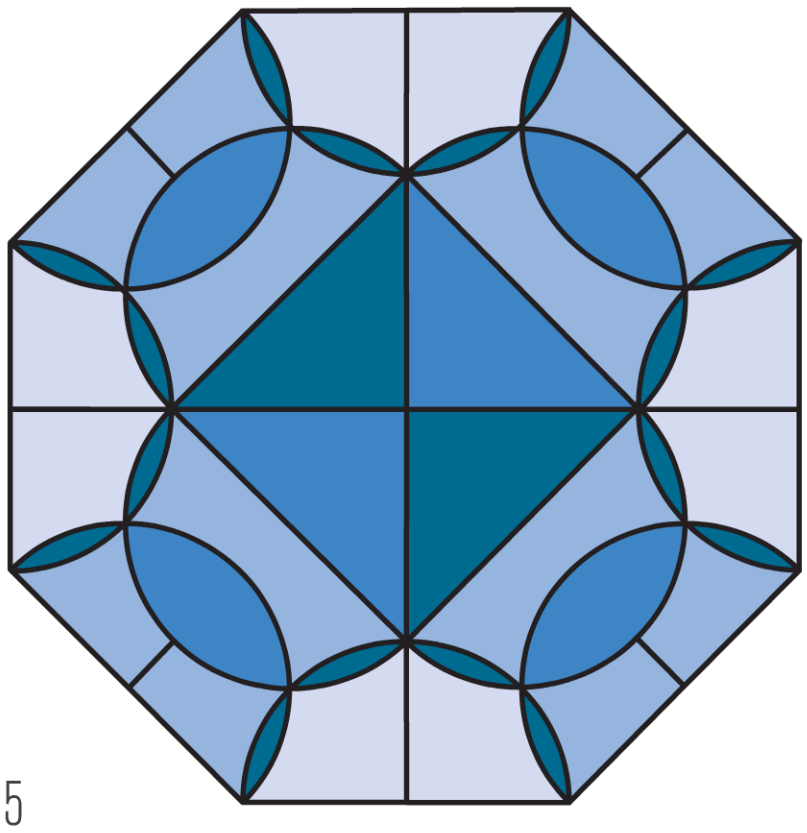

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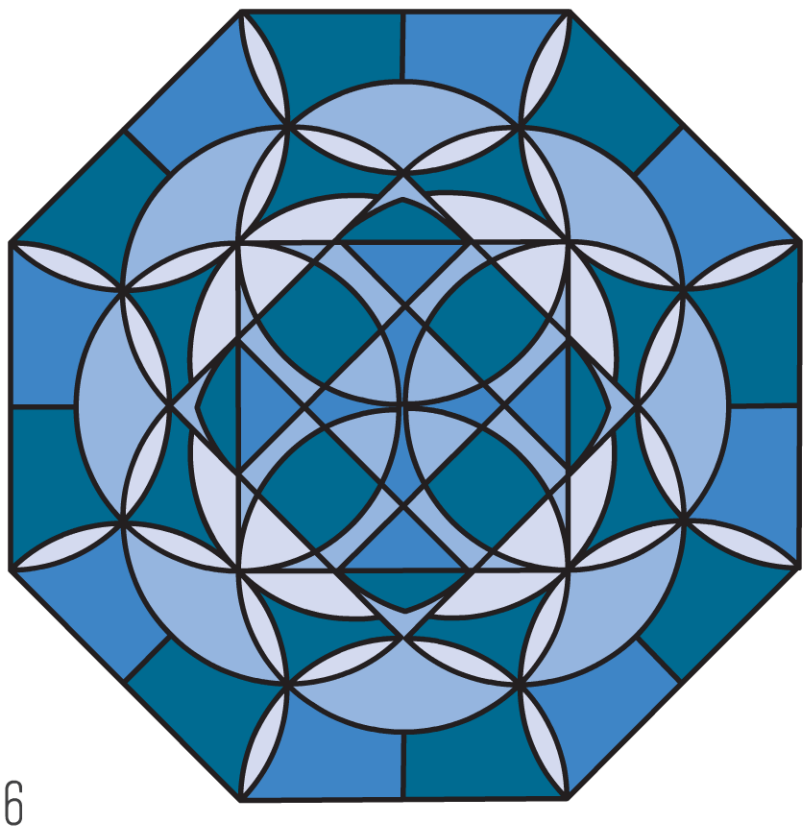

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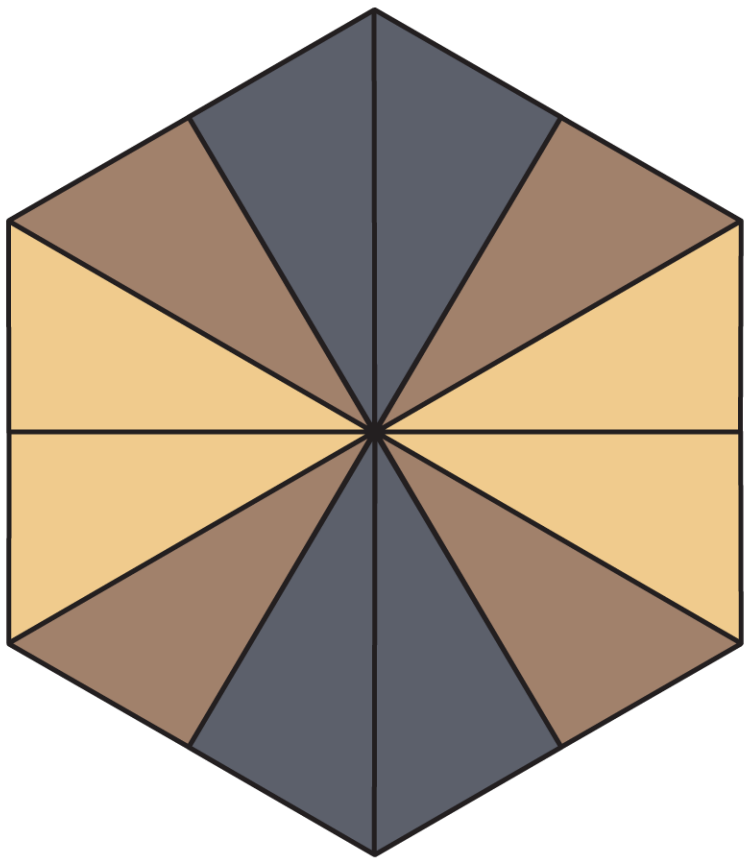
Hexagons



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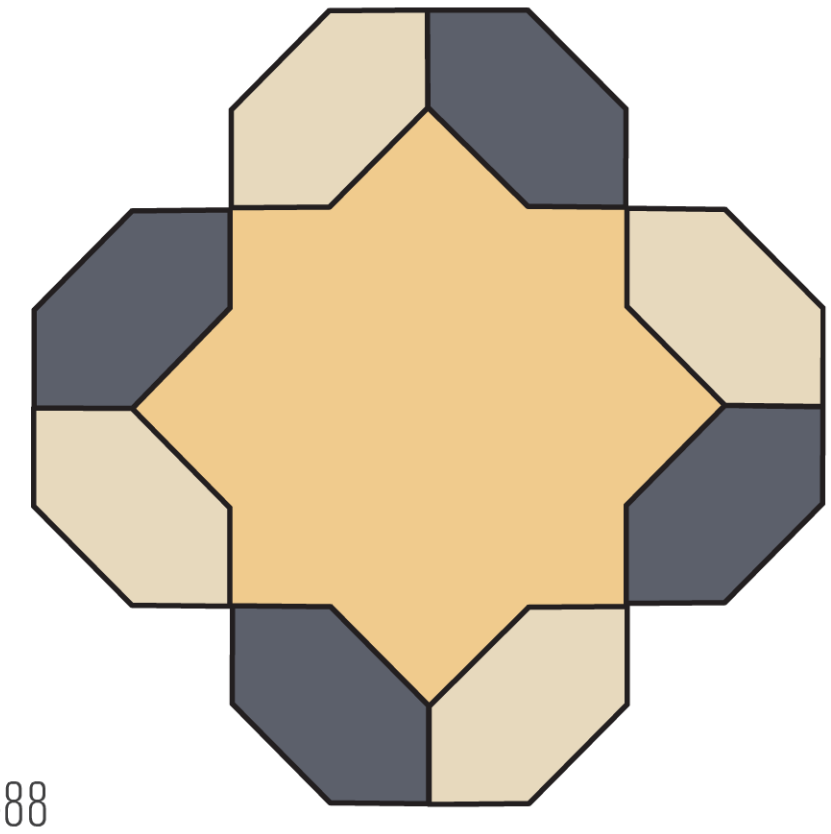

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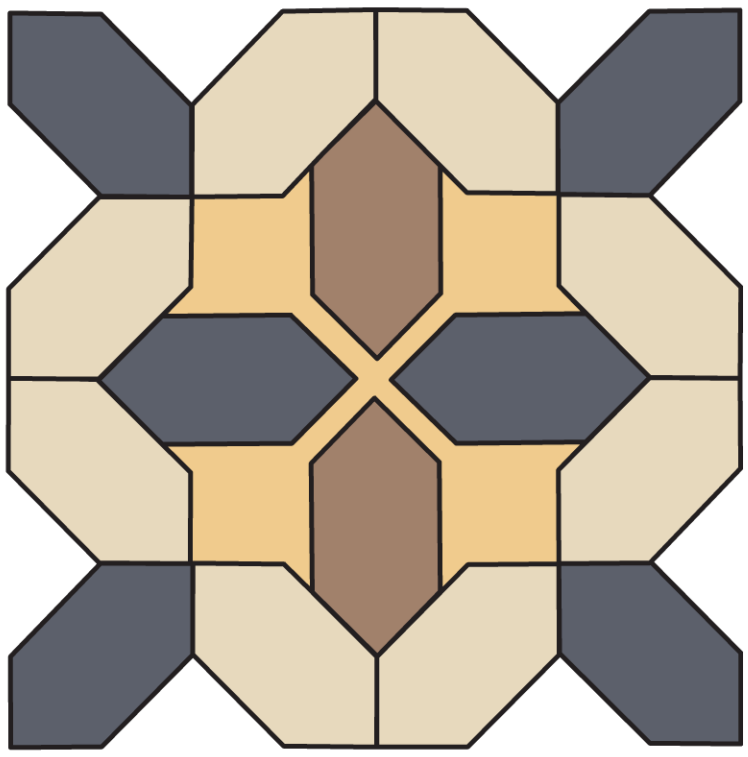

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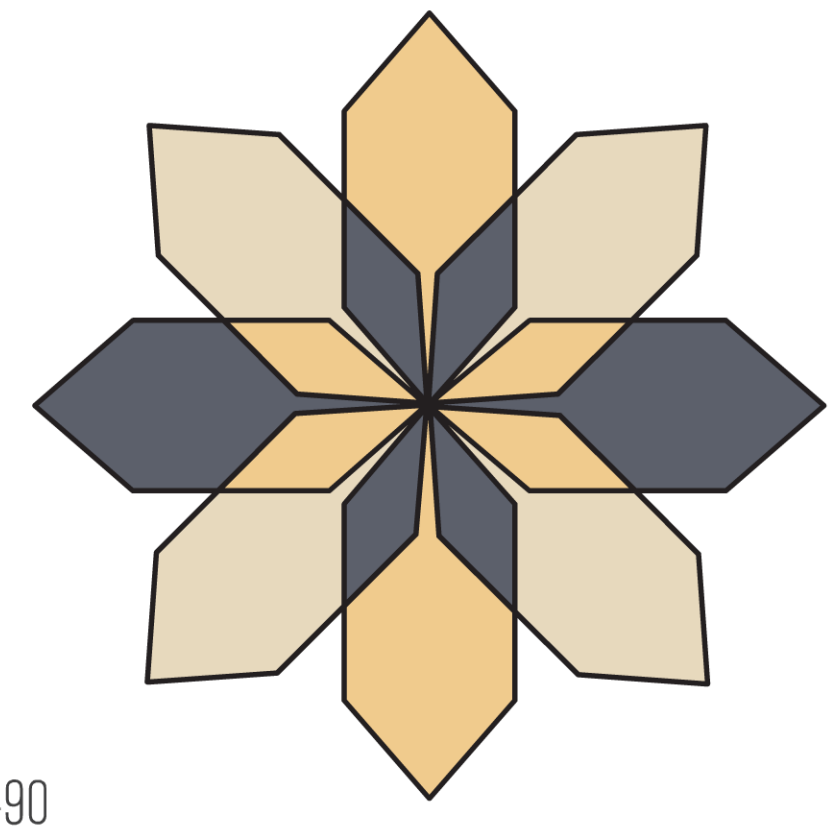

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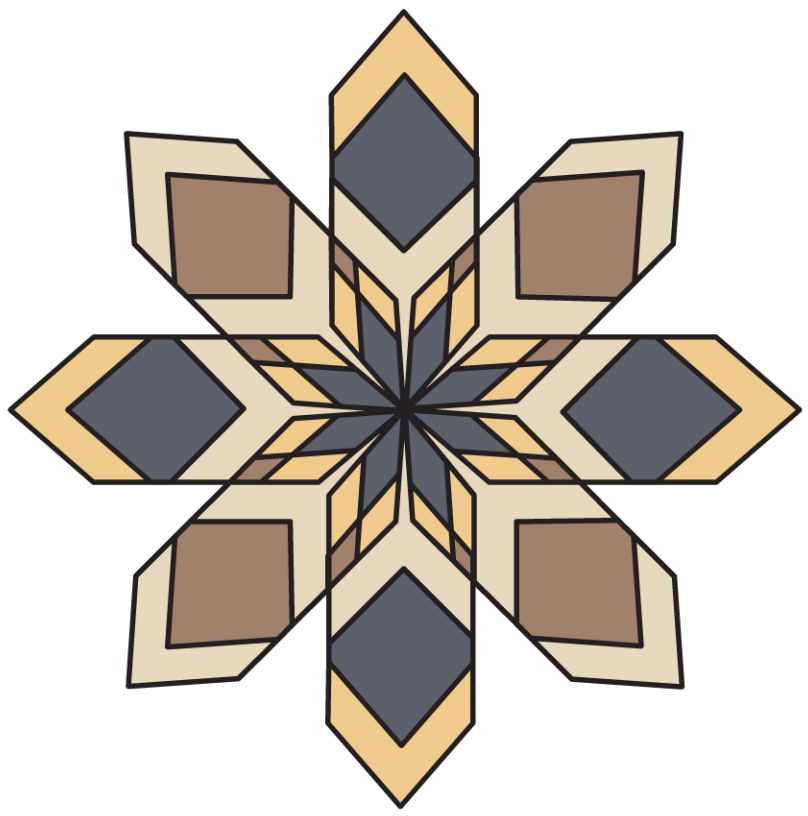

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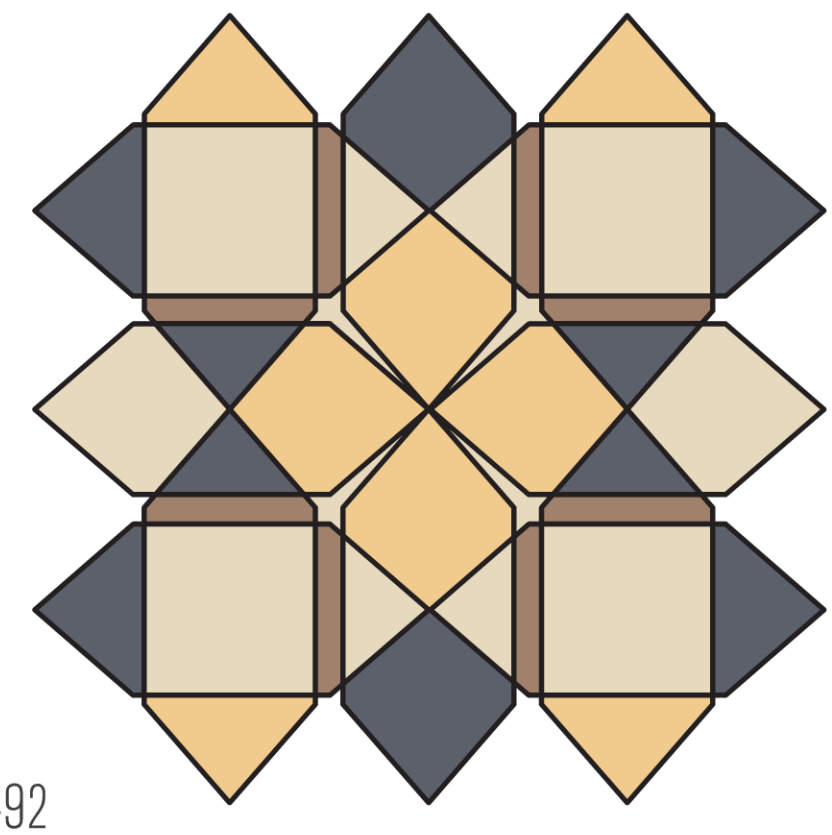

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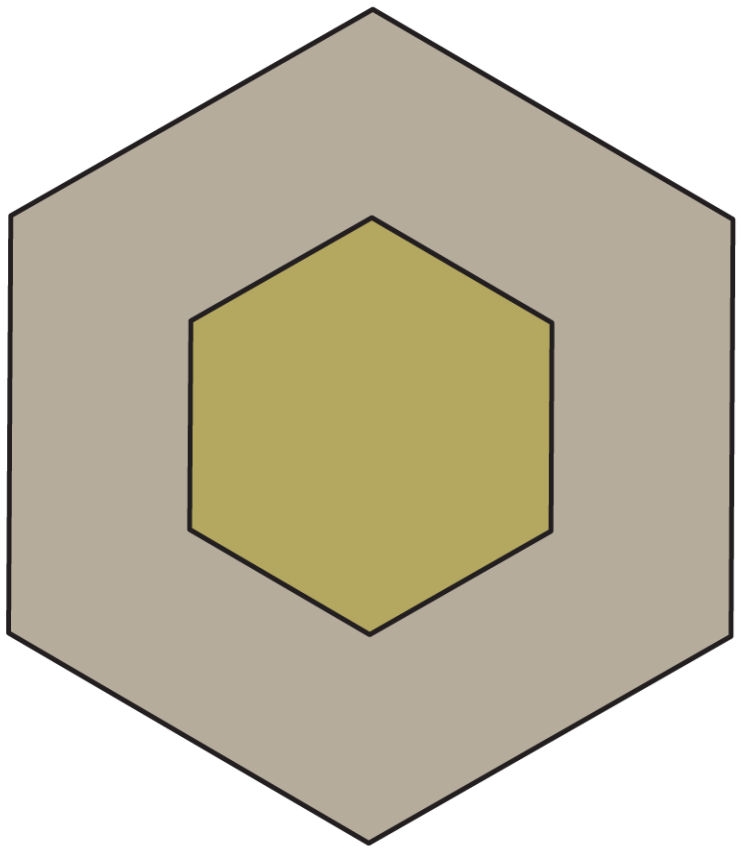
Hexagons Divided



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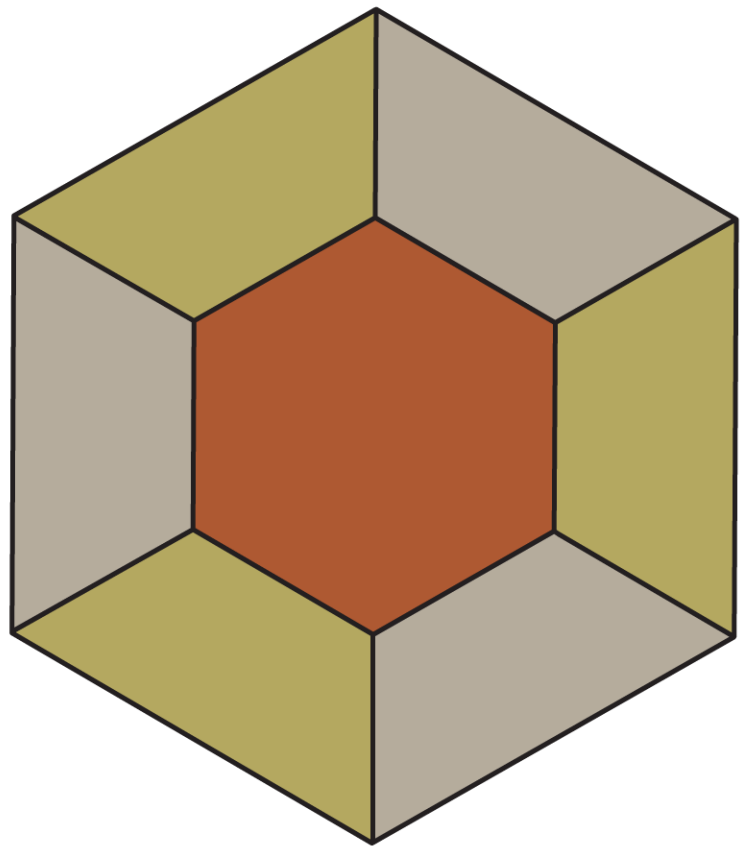

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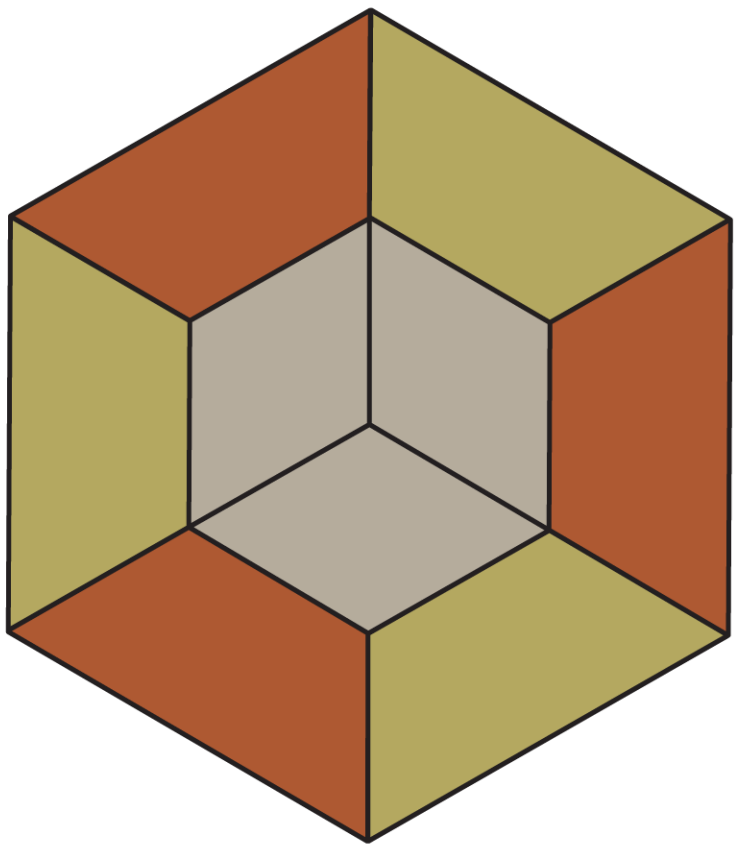

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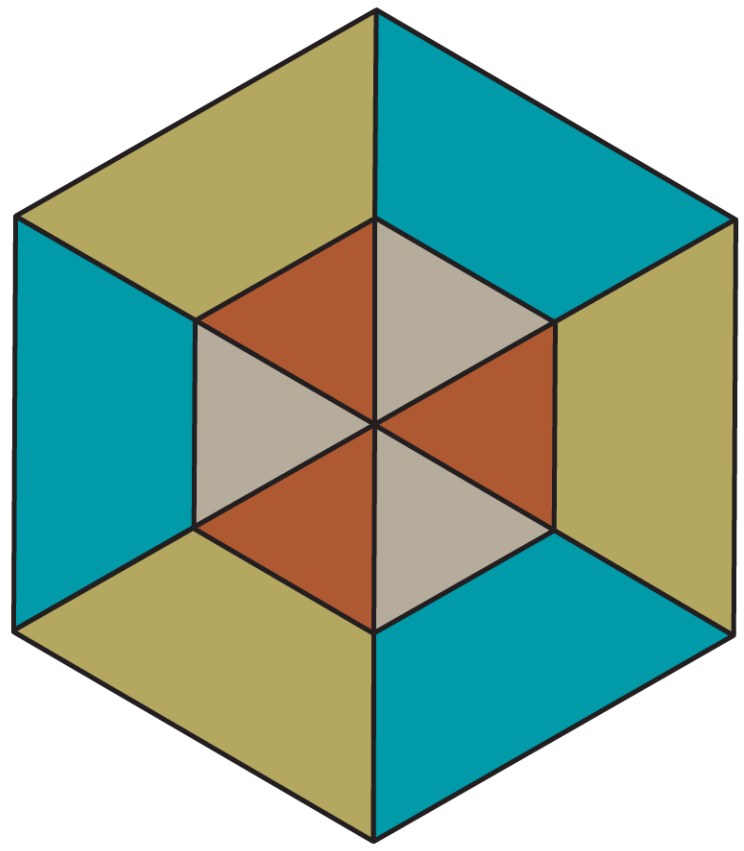

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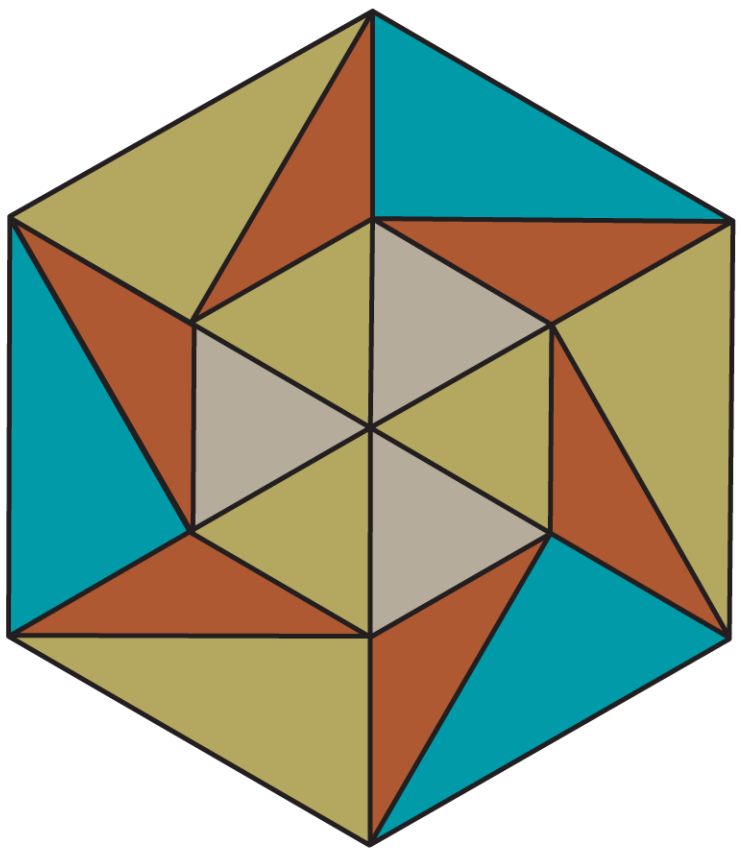

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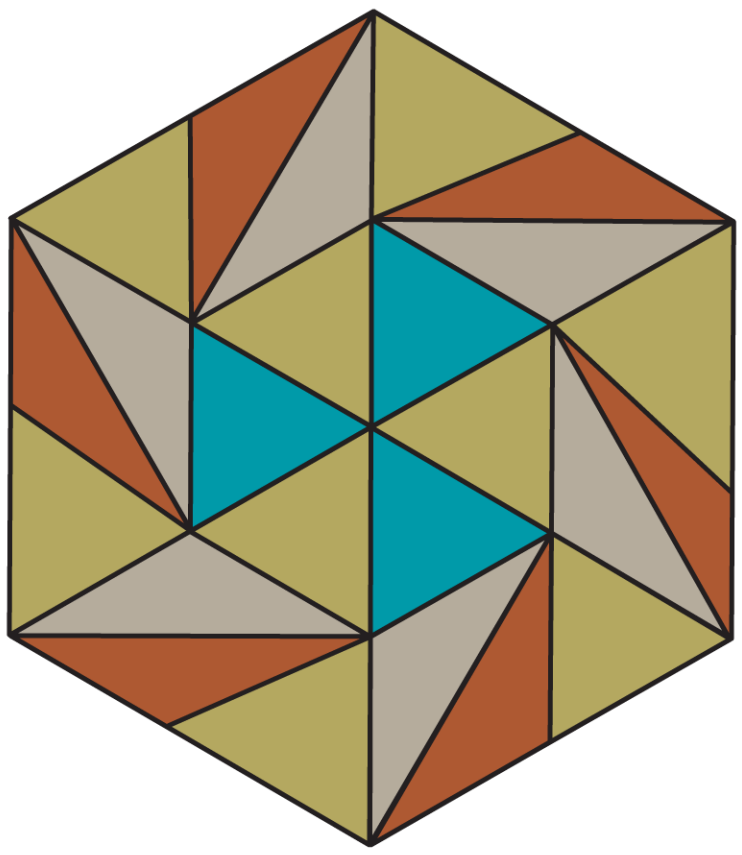

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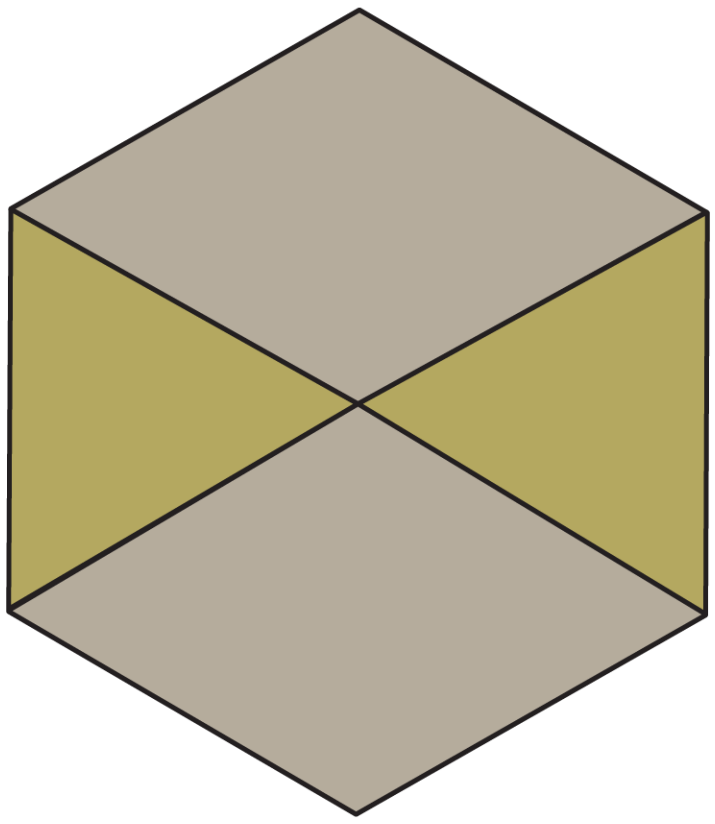

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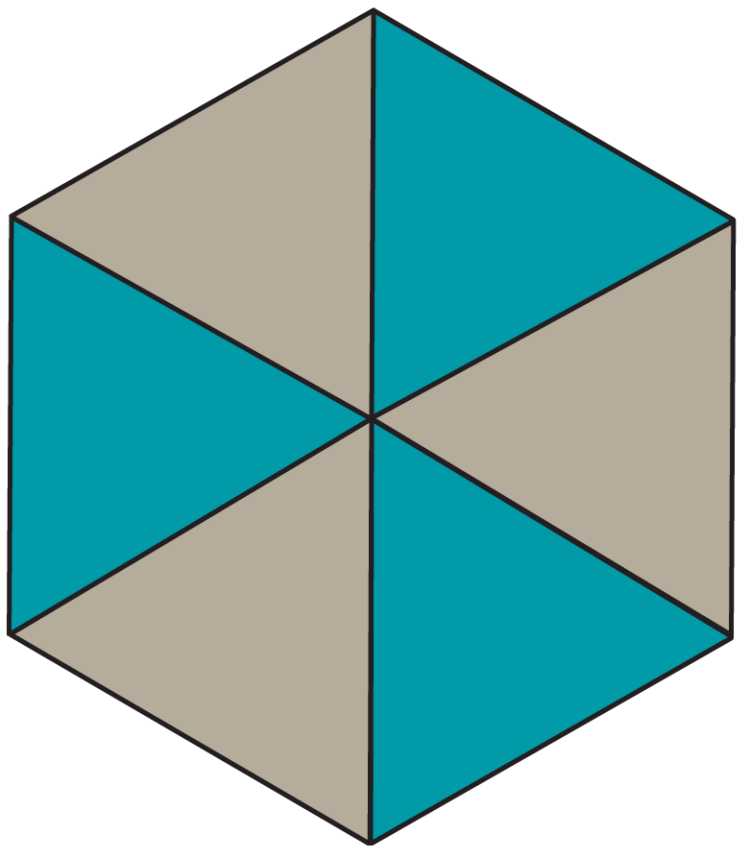

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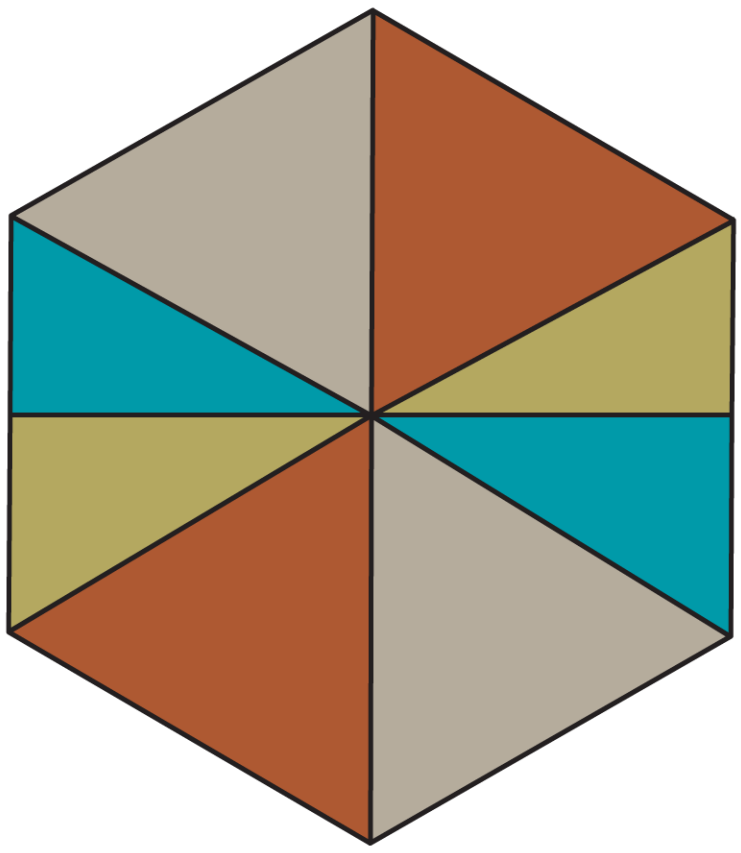

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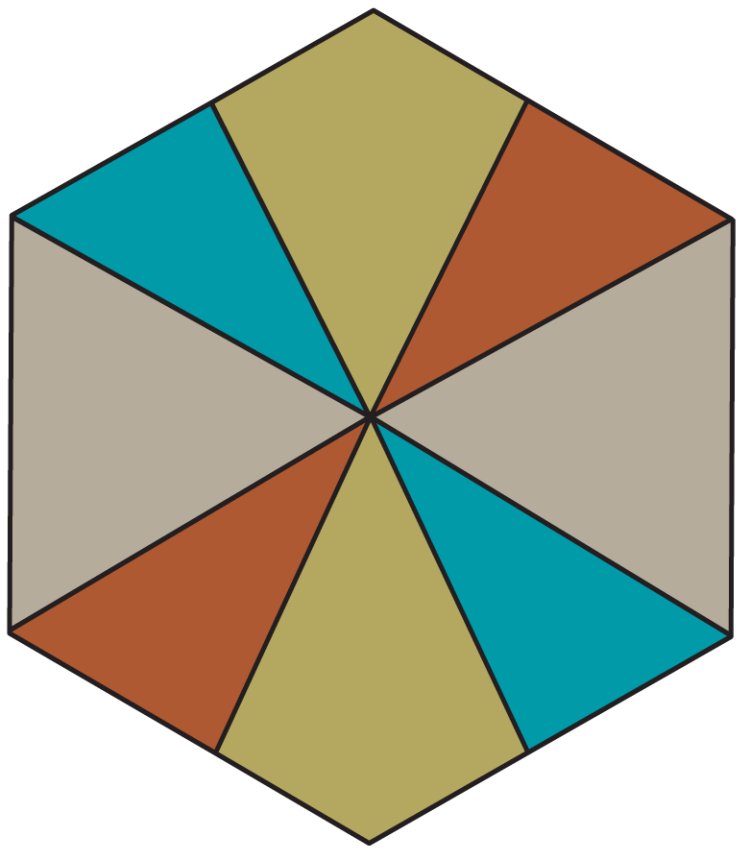

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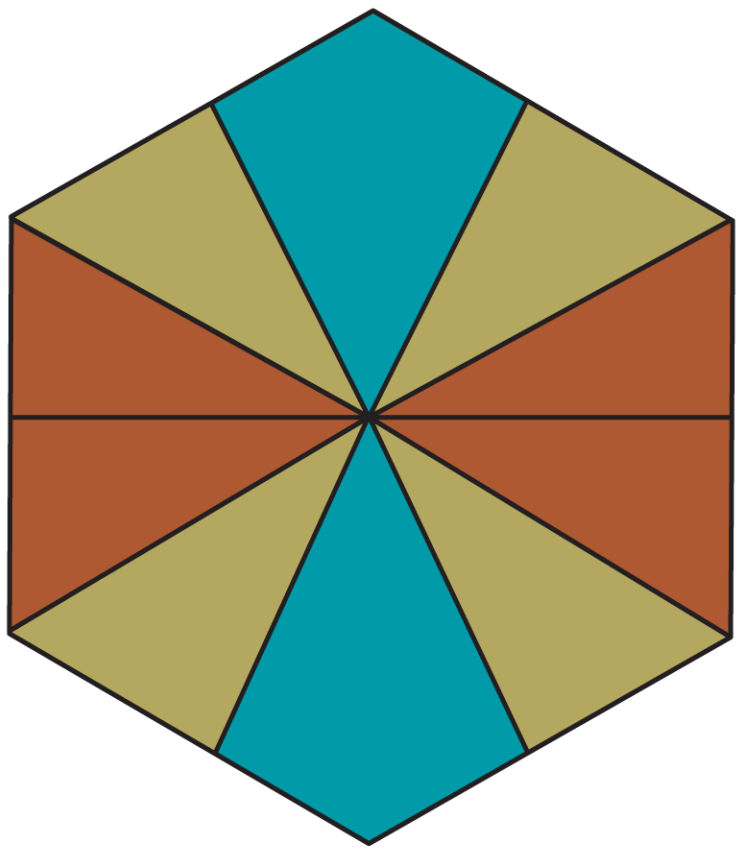

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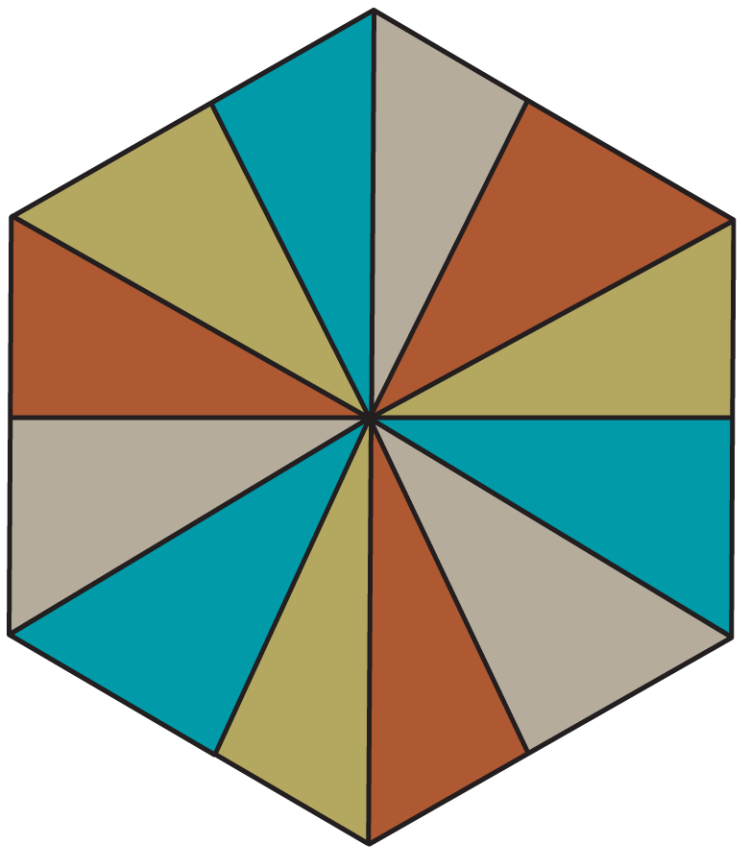

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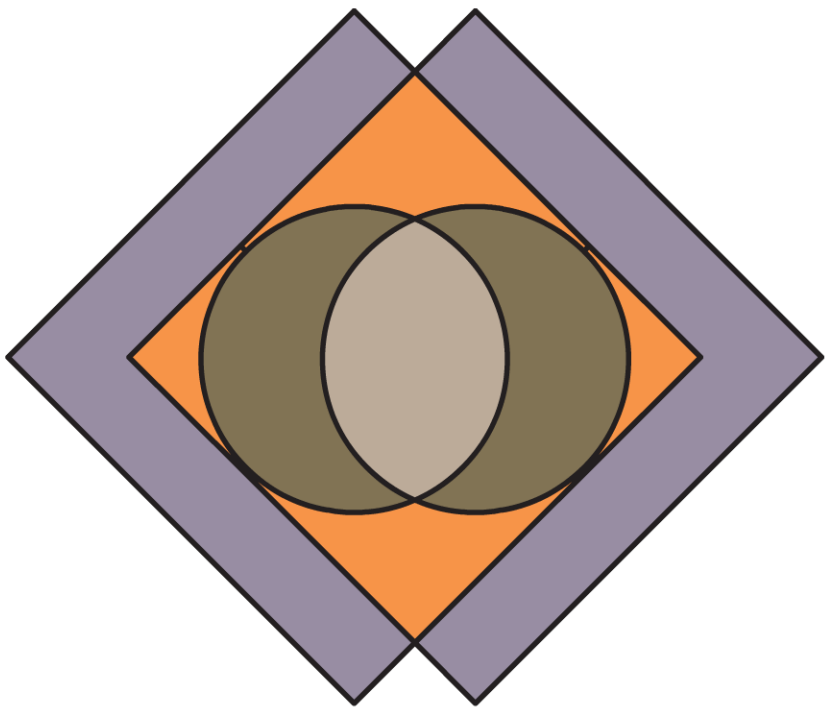

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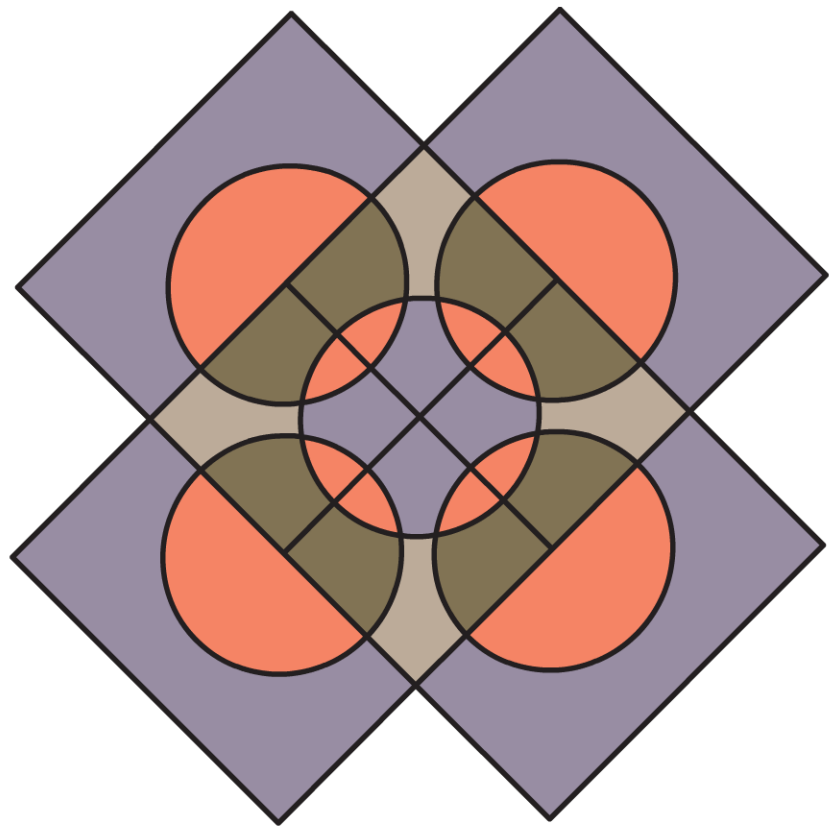

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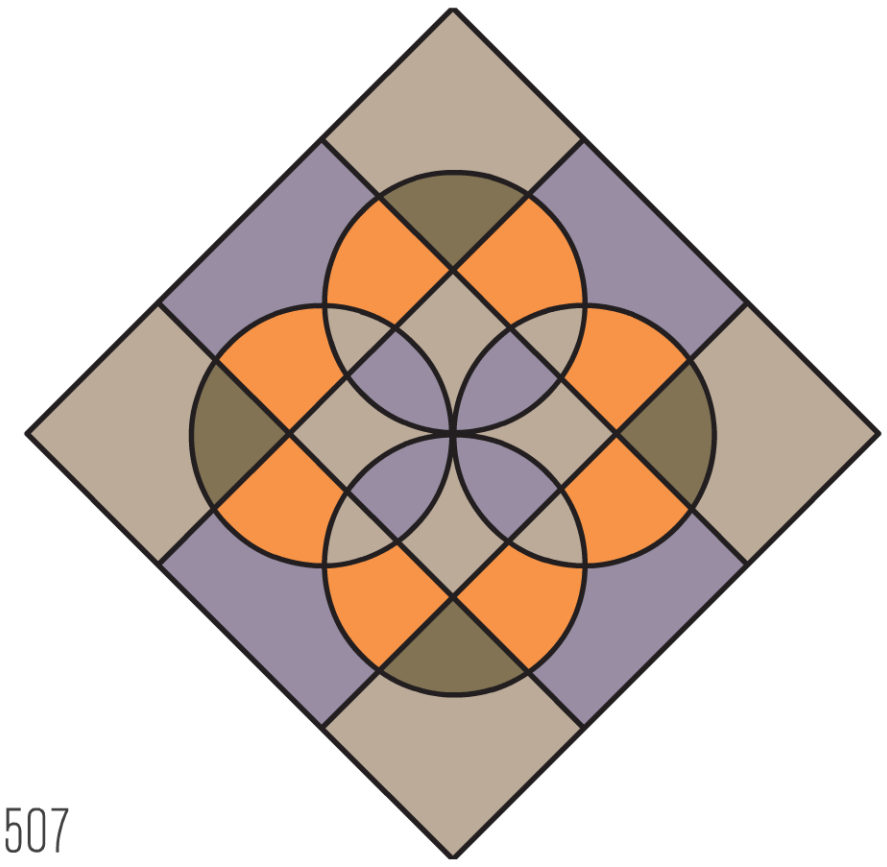

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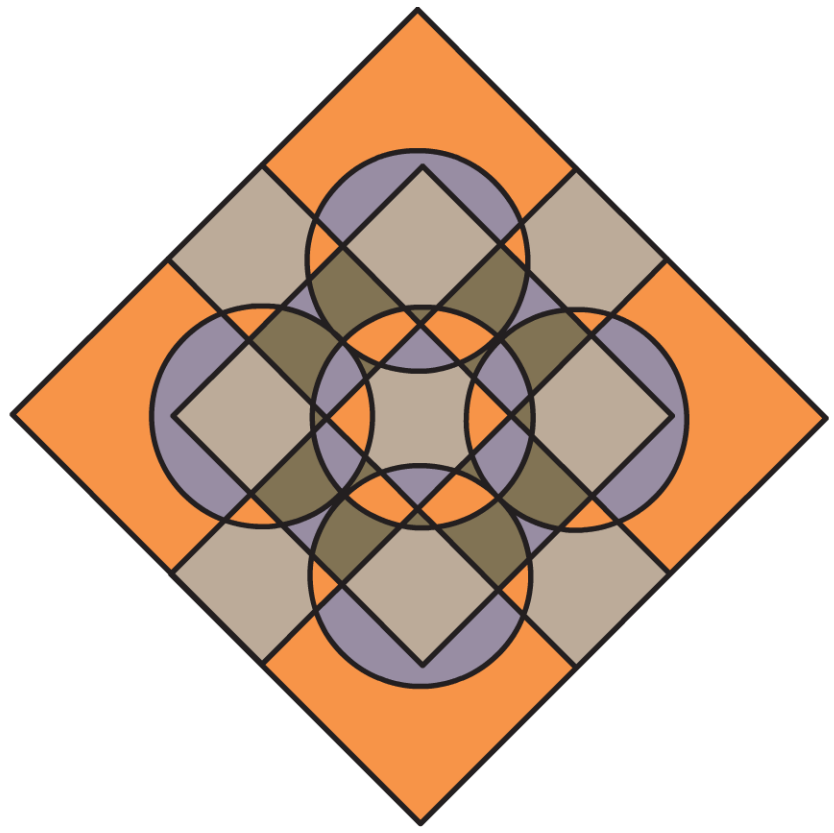

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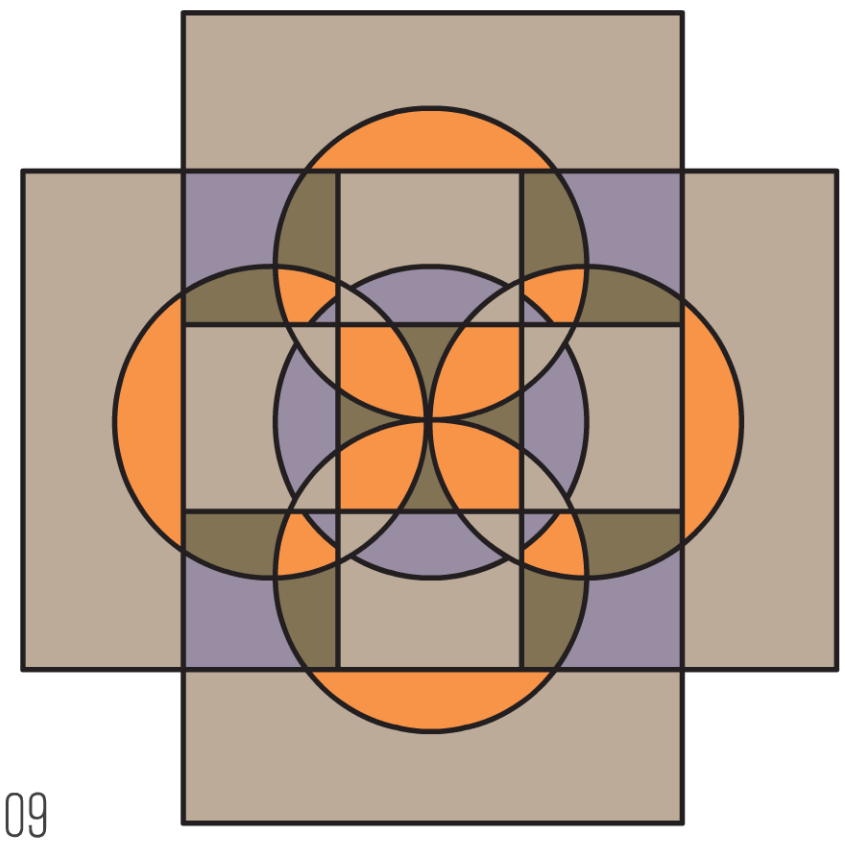

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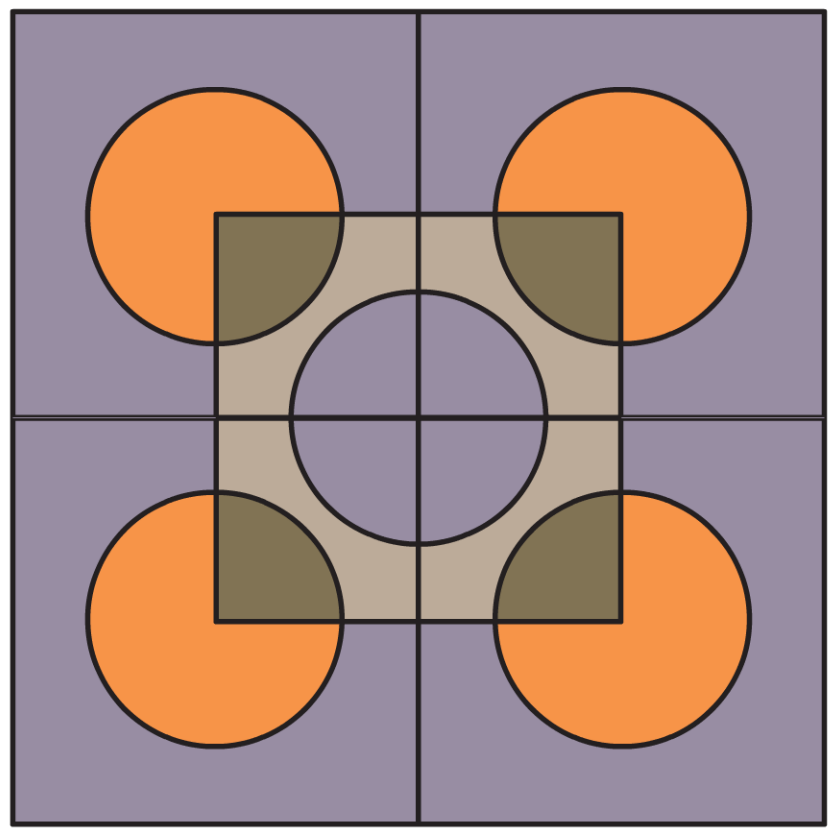

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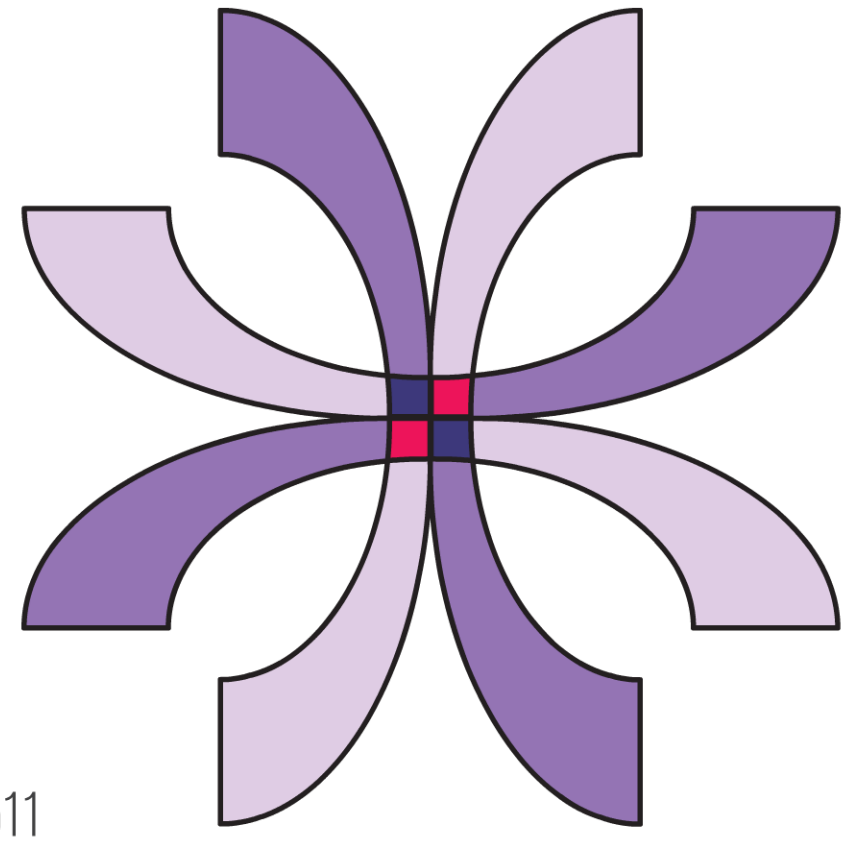

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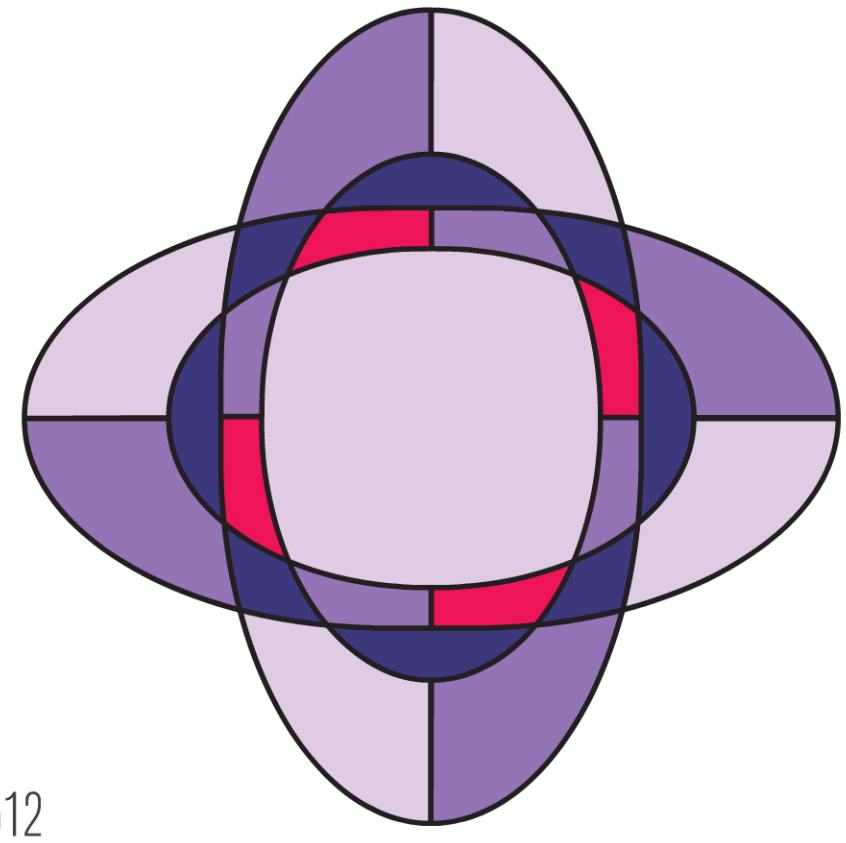

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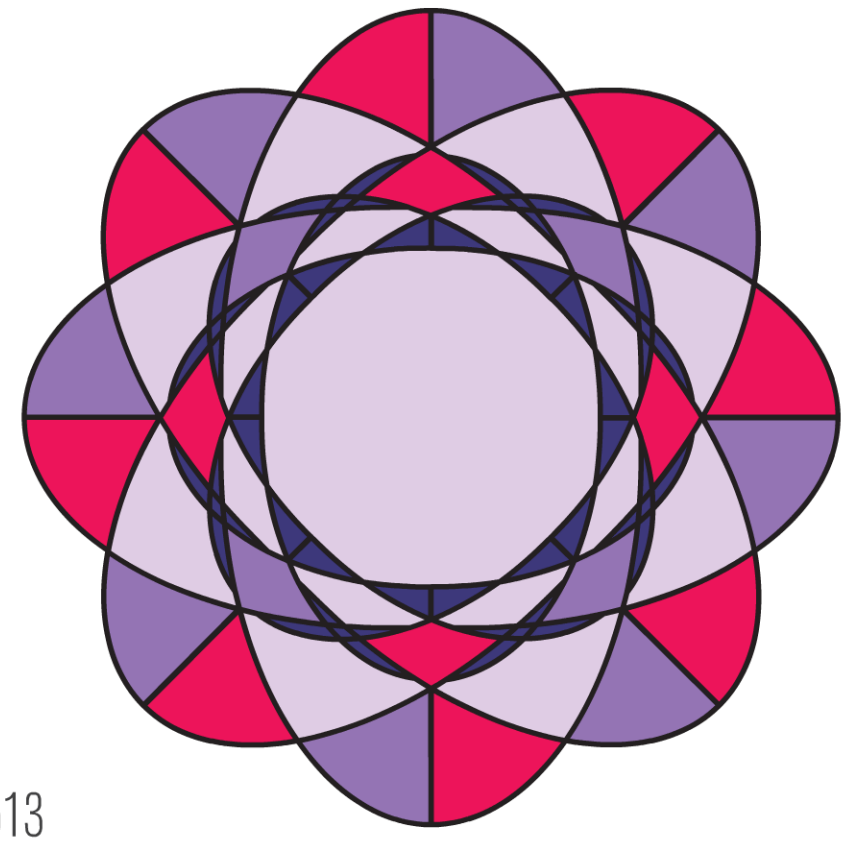

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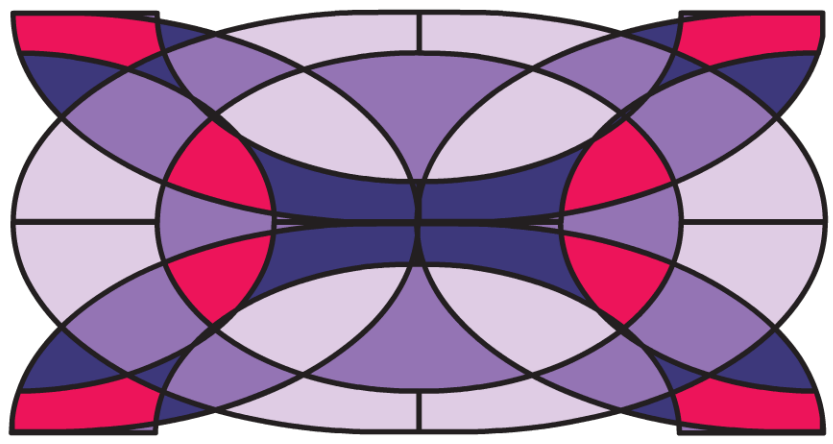

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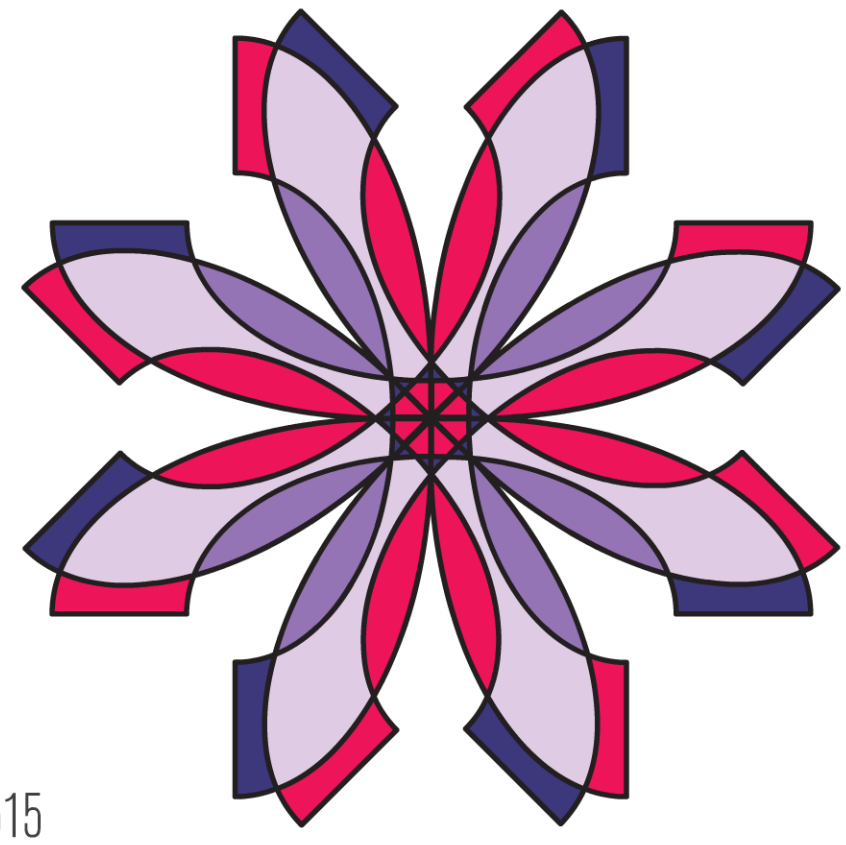

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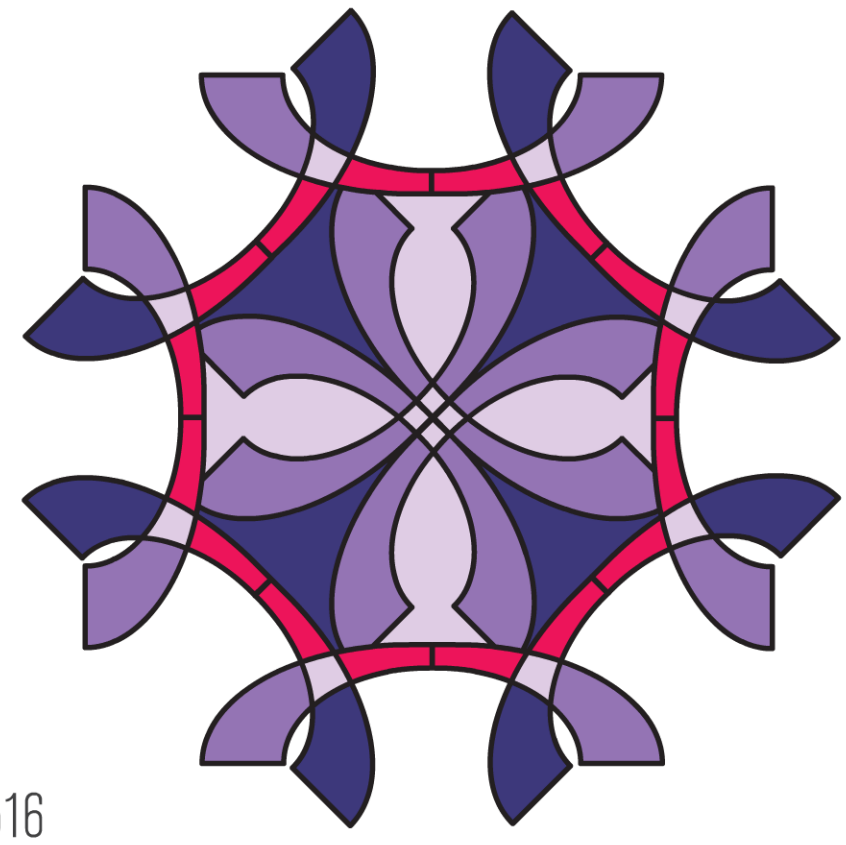

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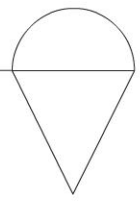
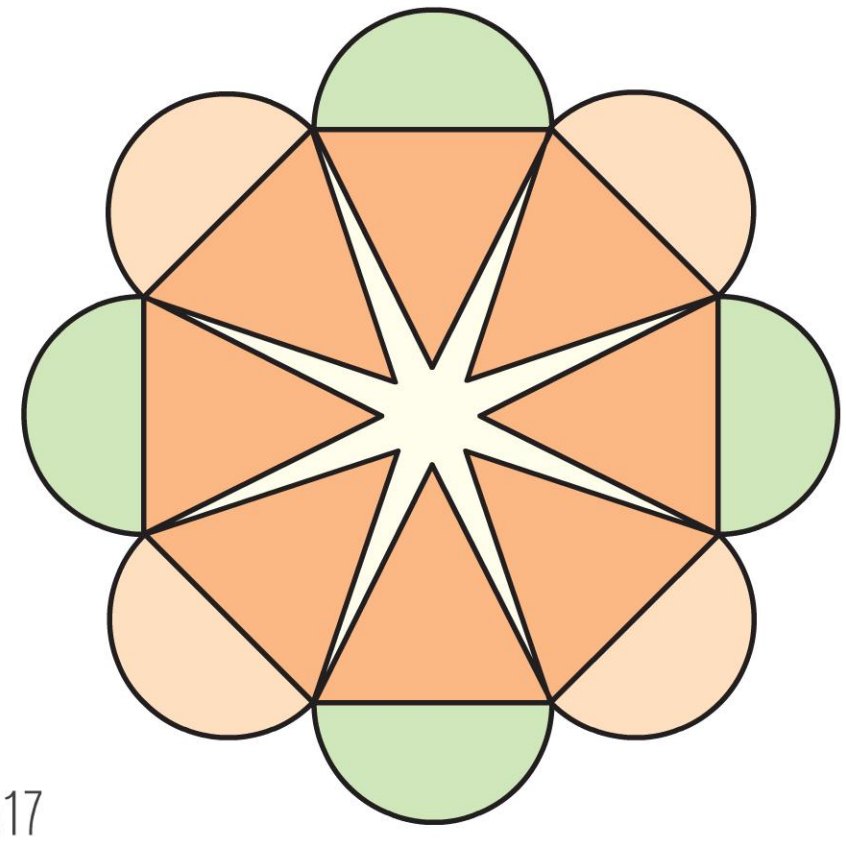


Ice Cream Cones



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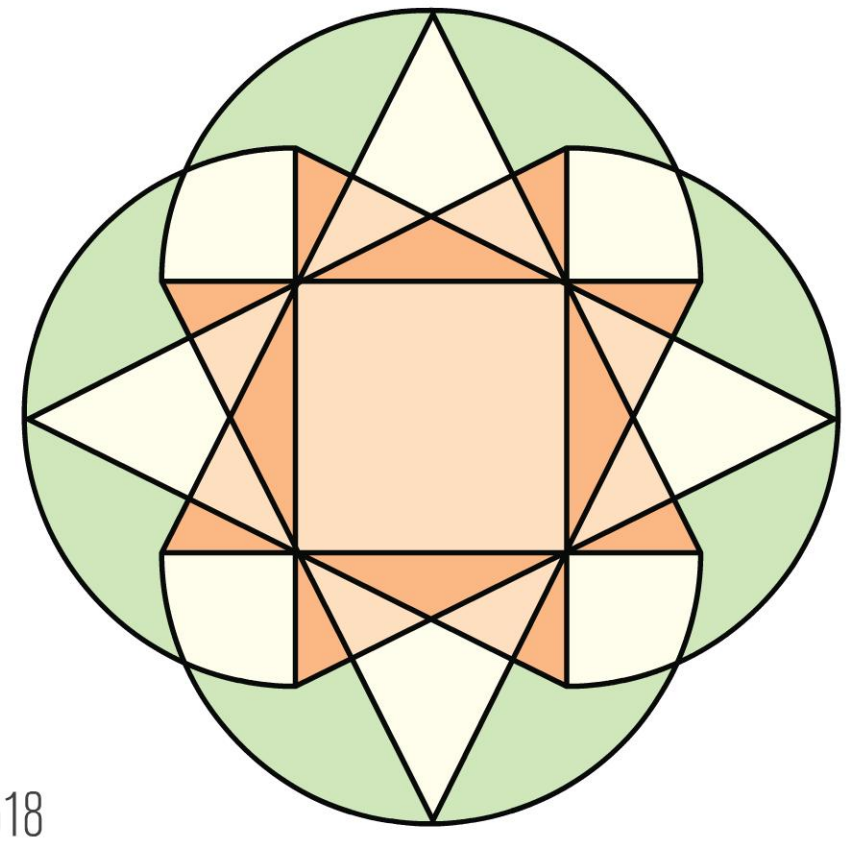

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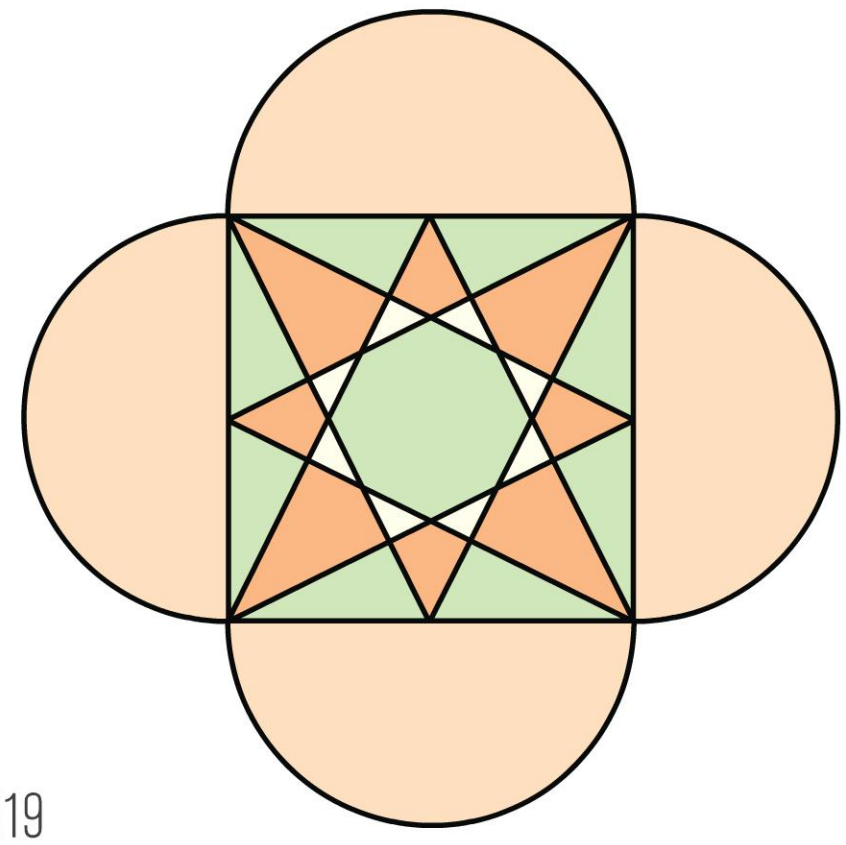

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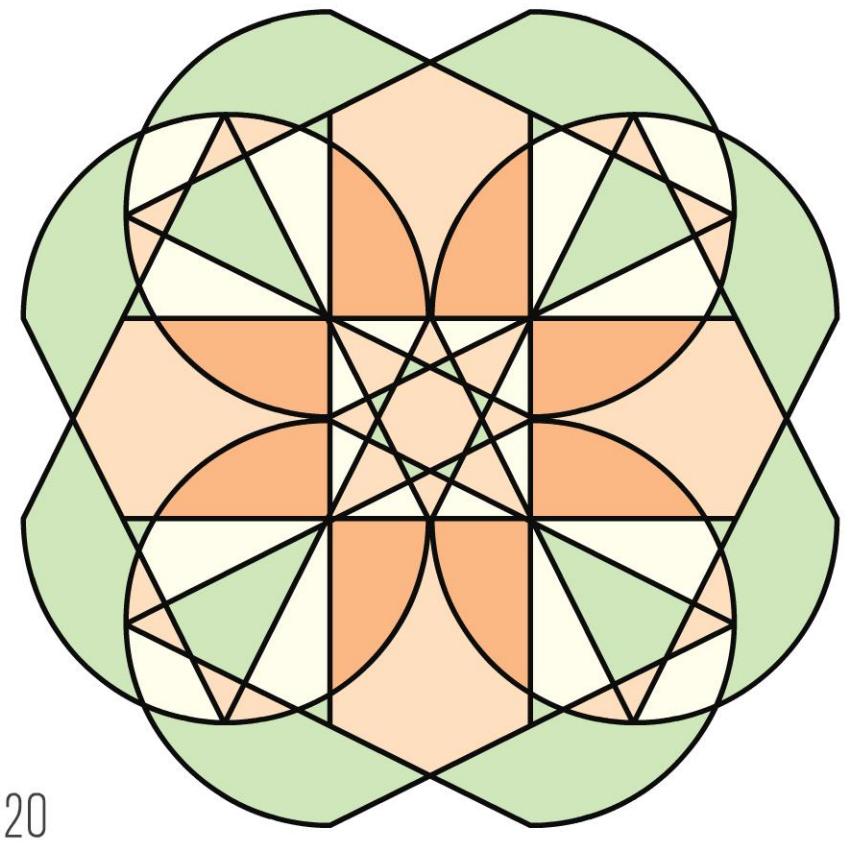

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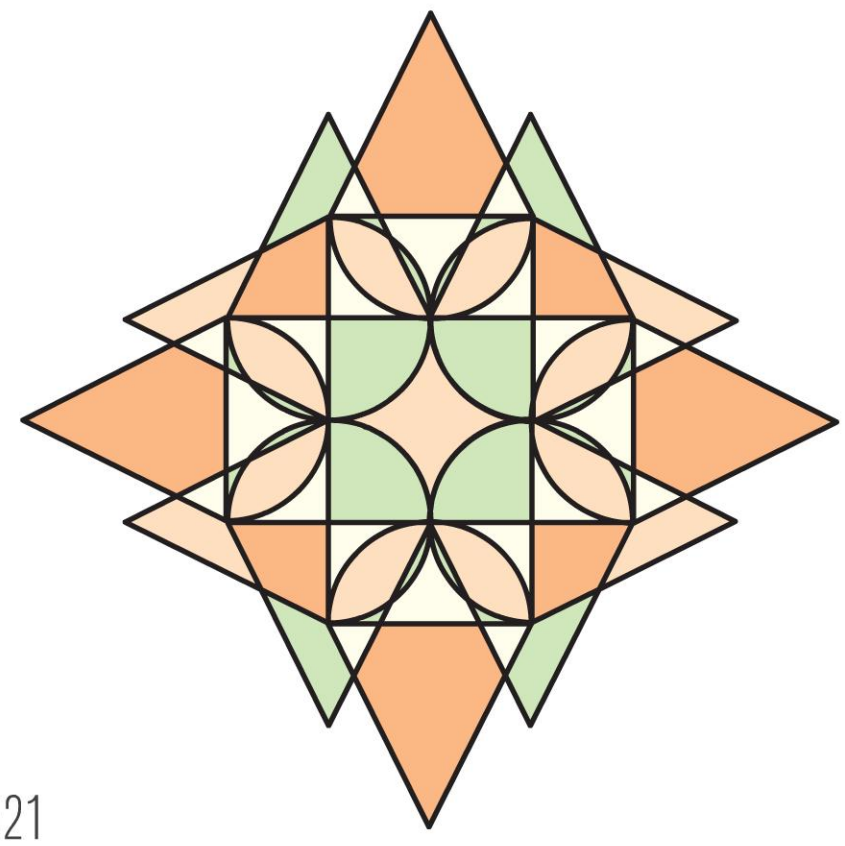

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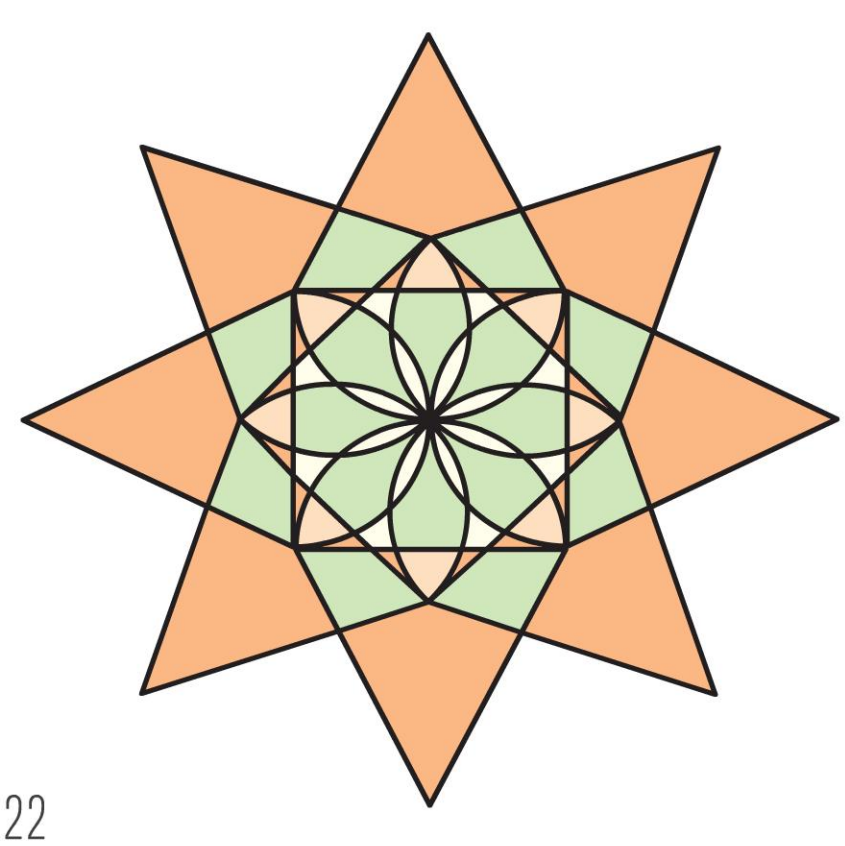

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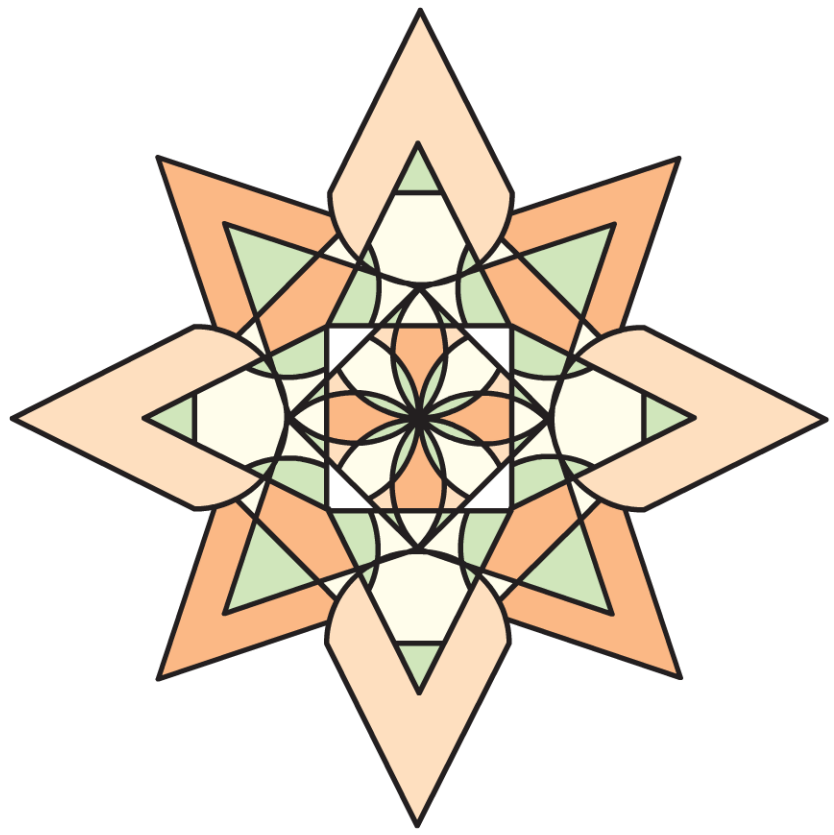

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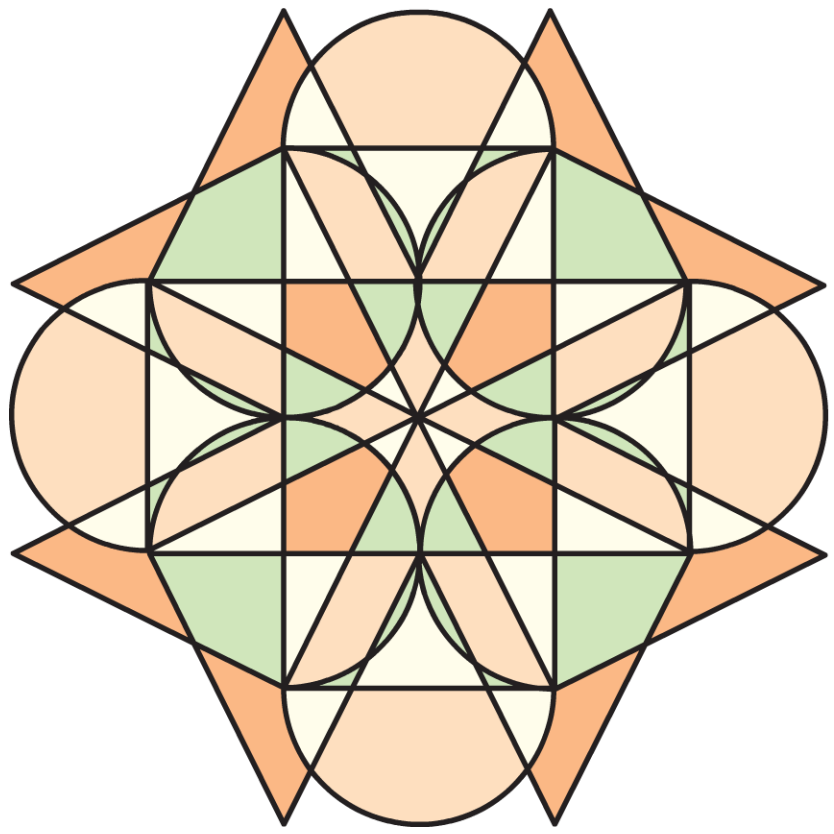

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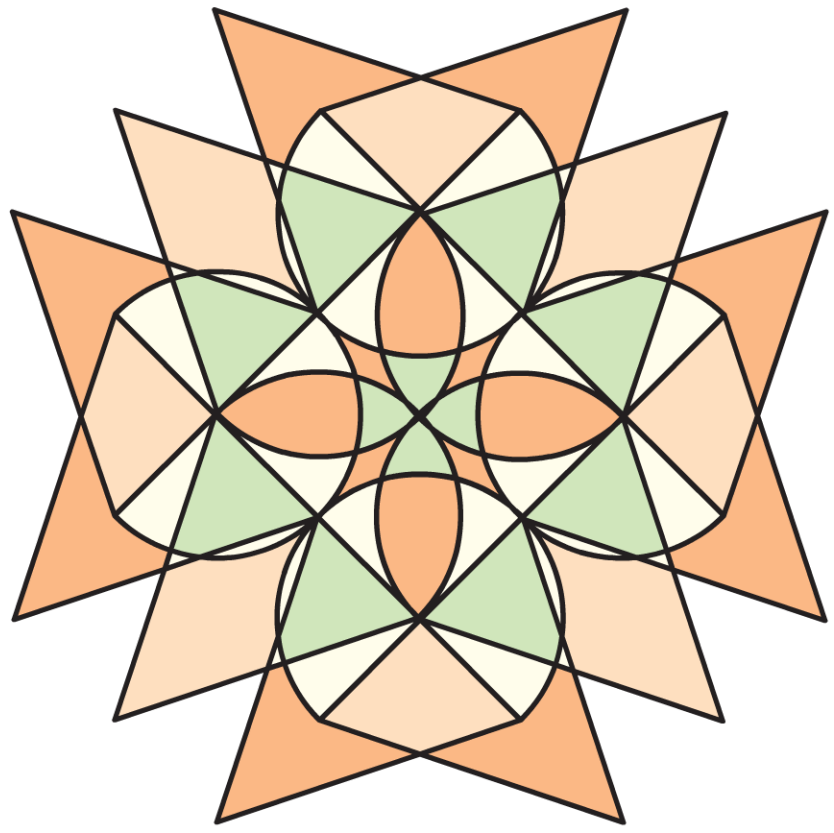

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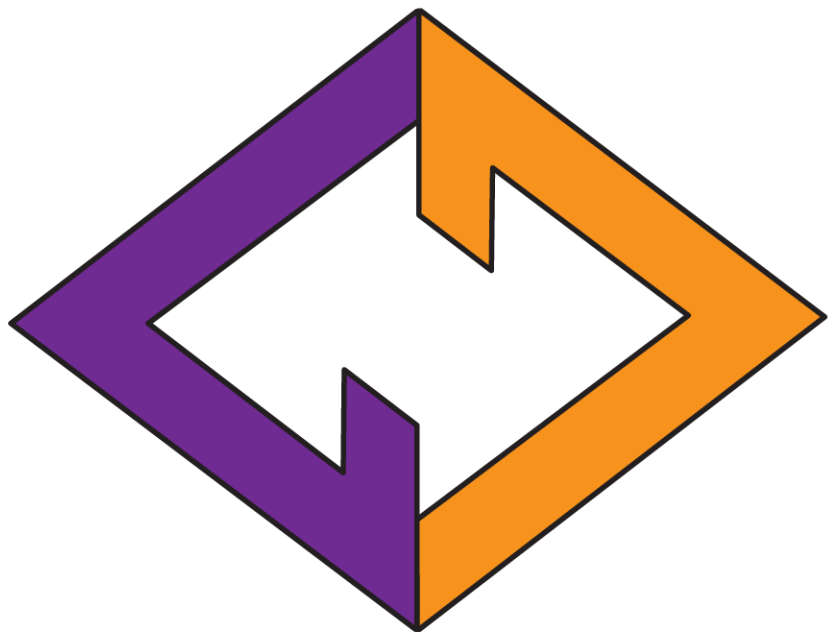
Kinked Chevrons



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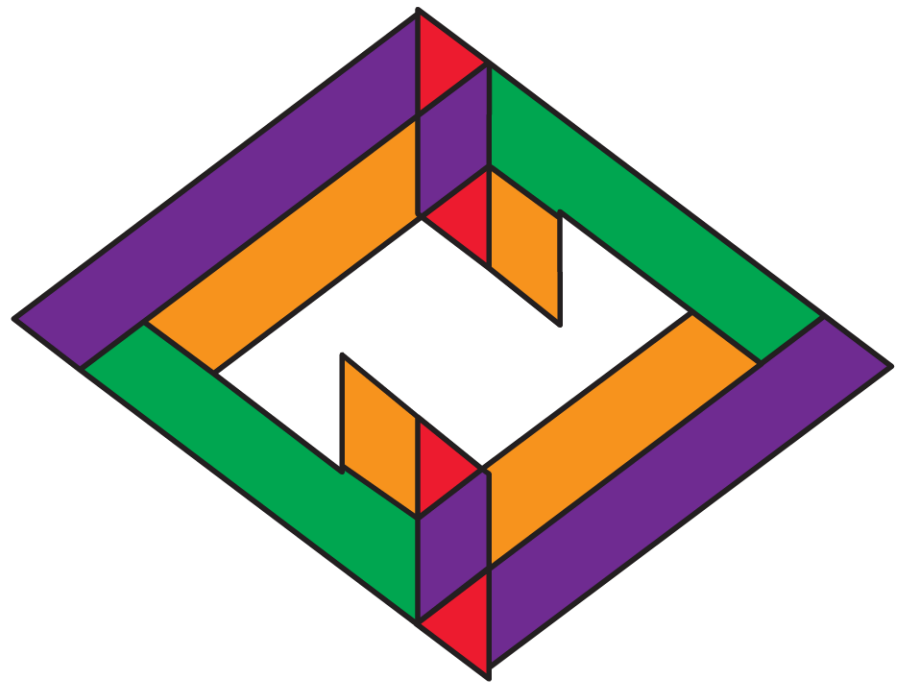

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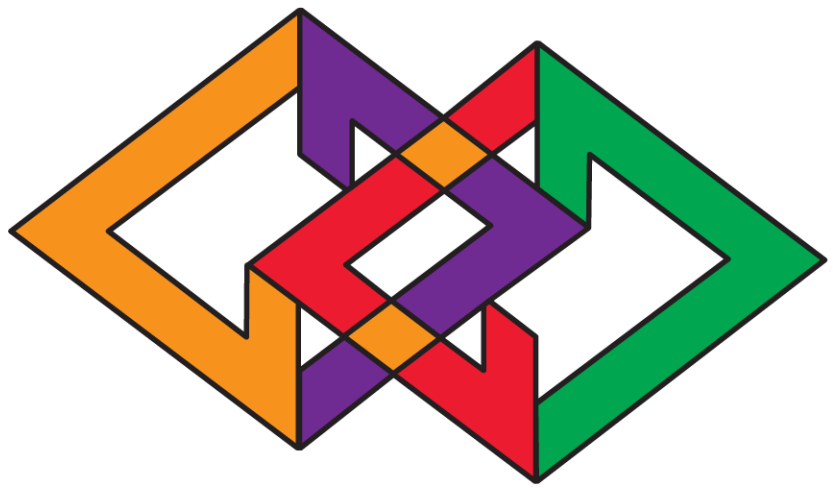

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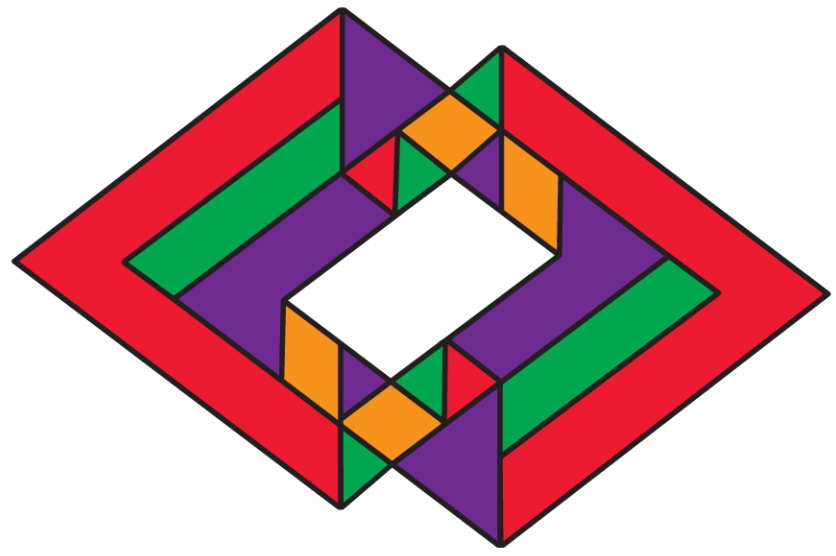

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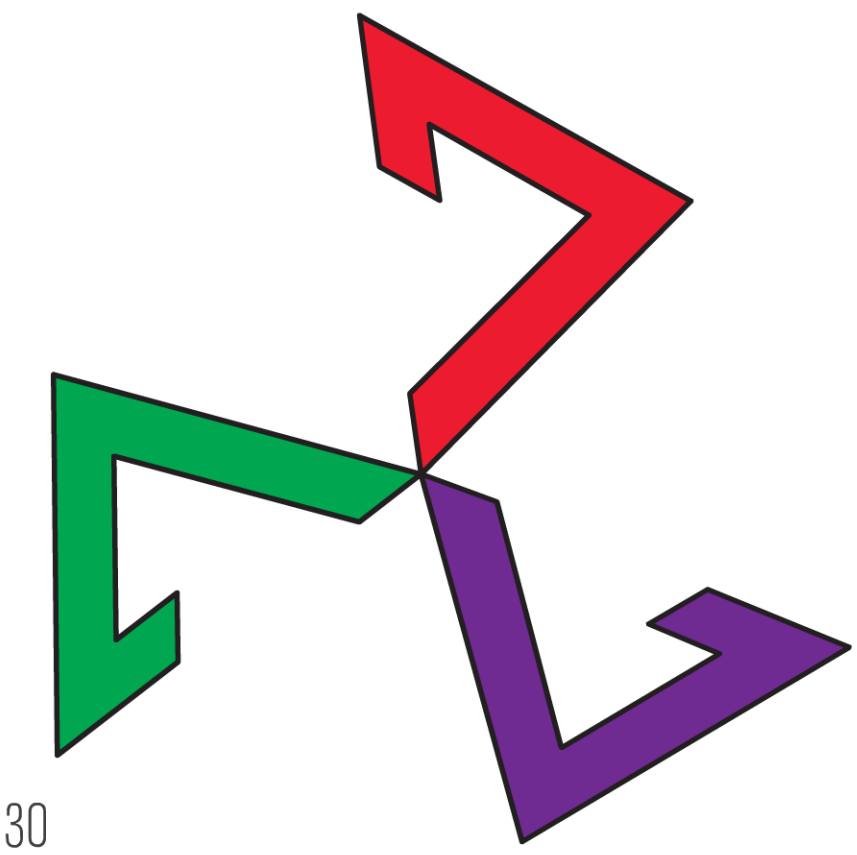

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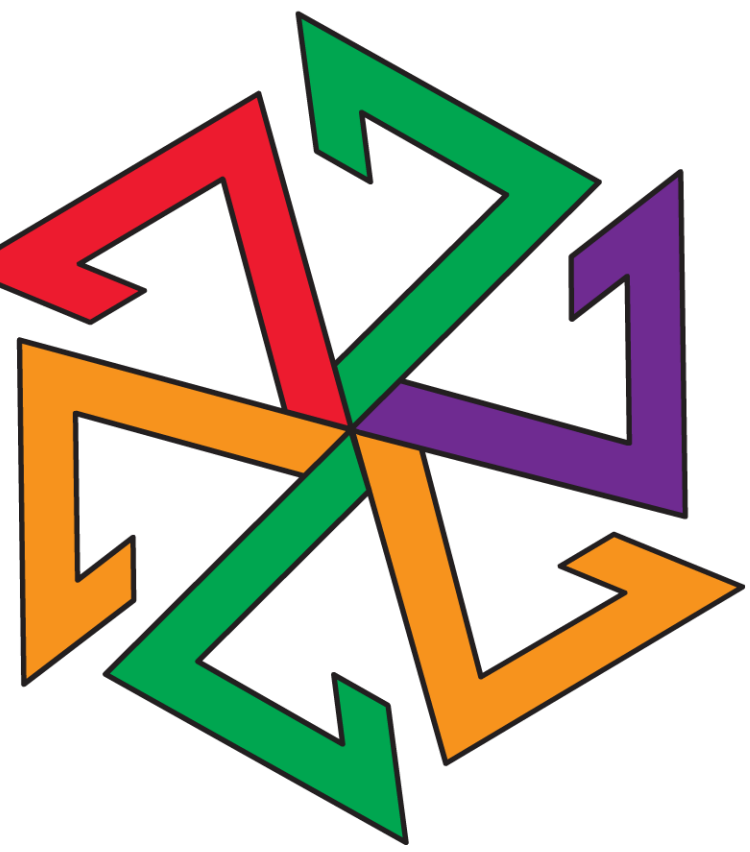

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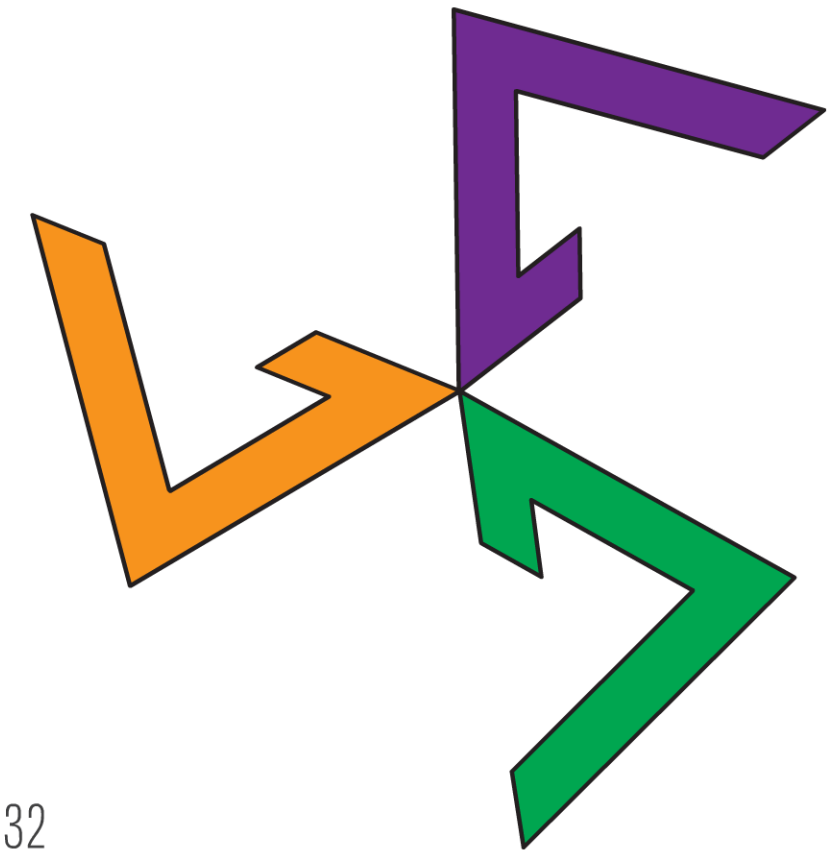

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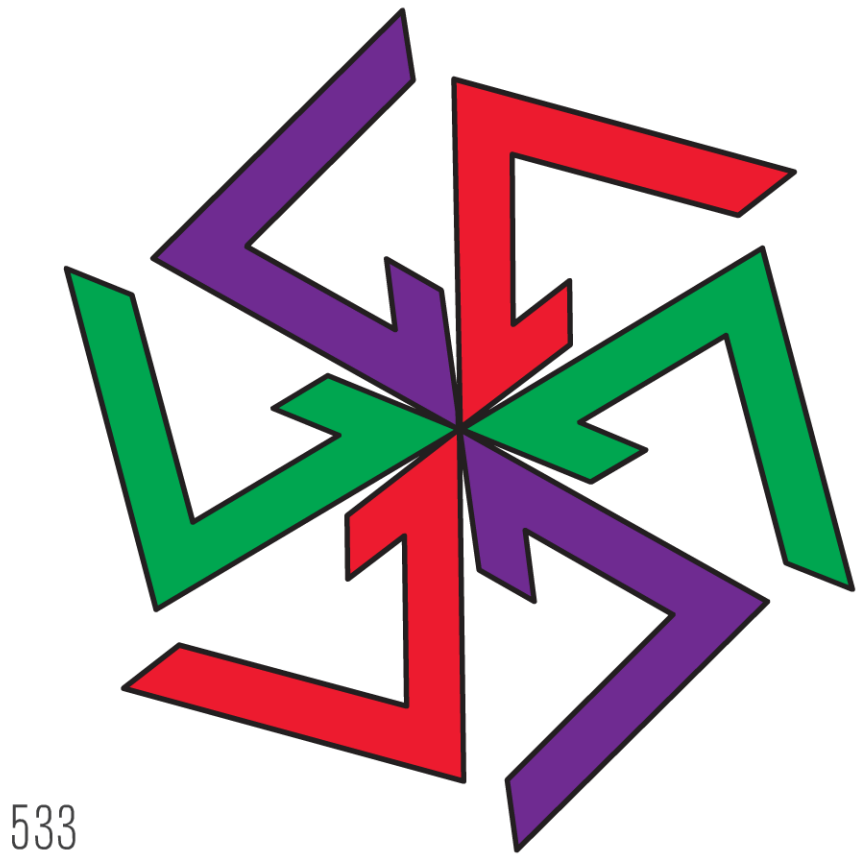

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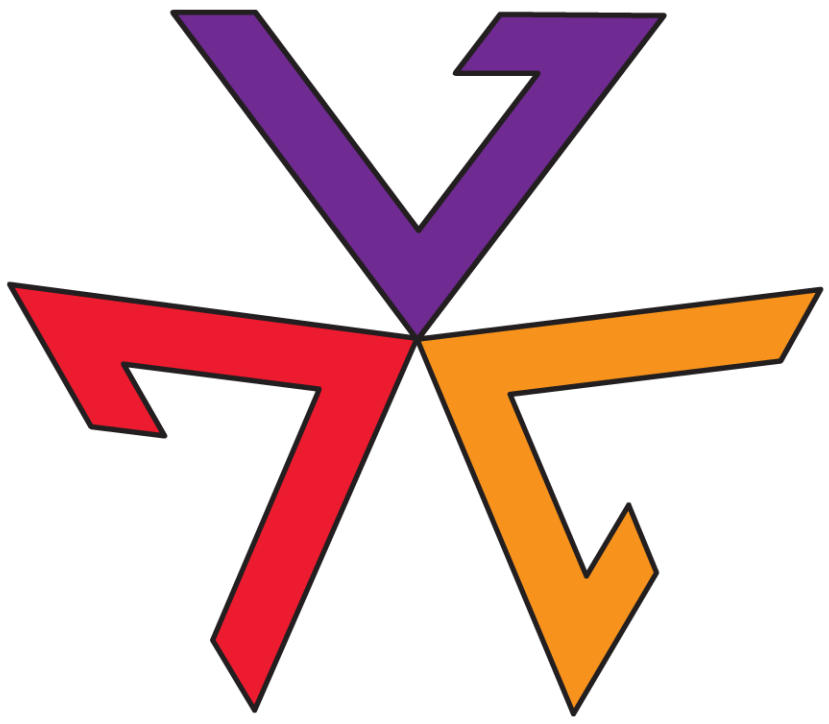

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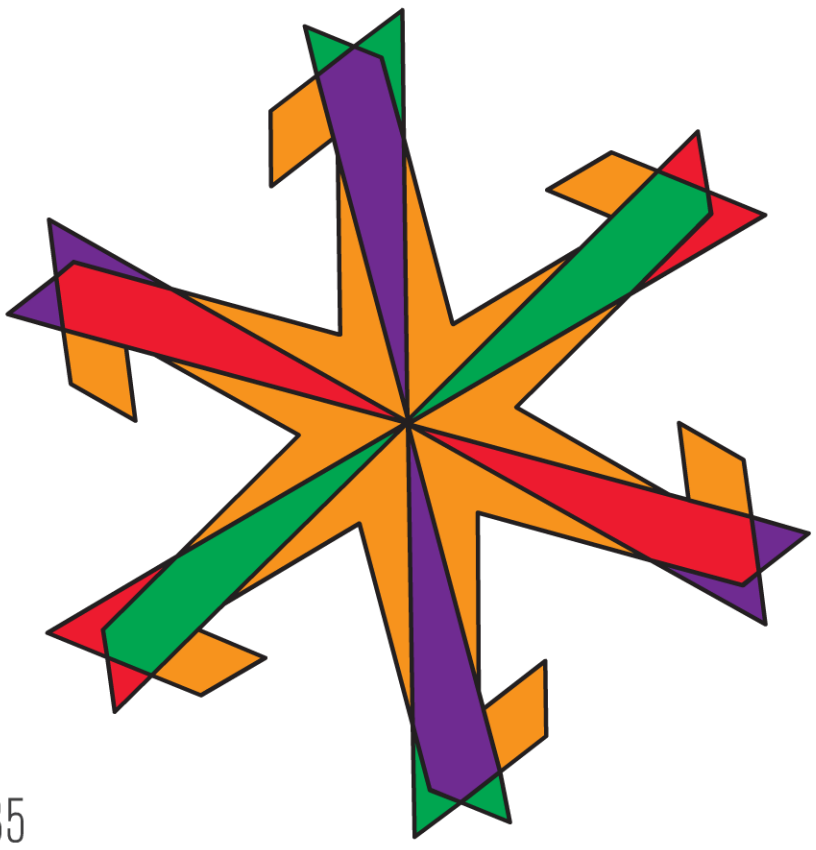

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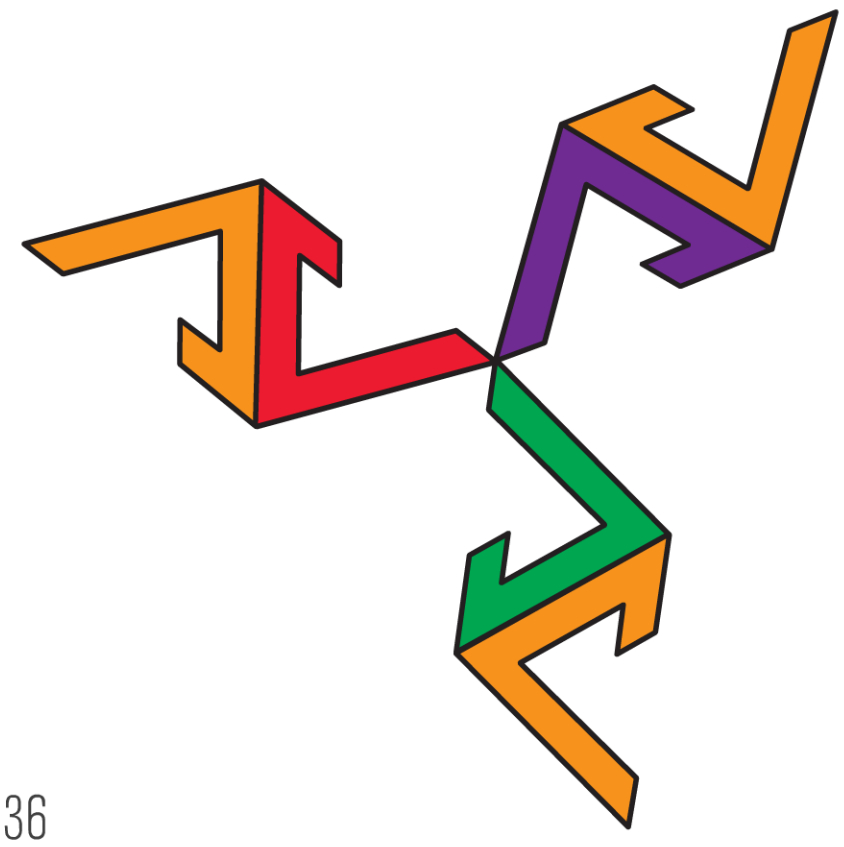

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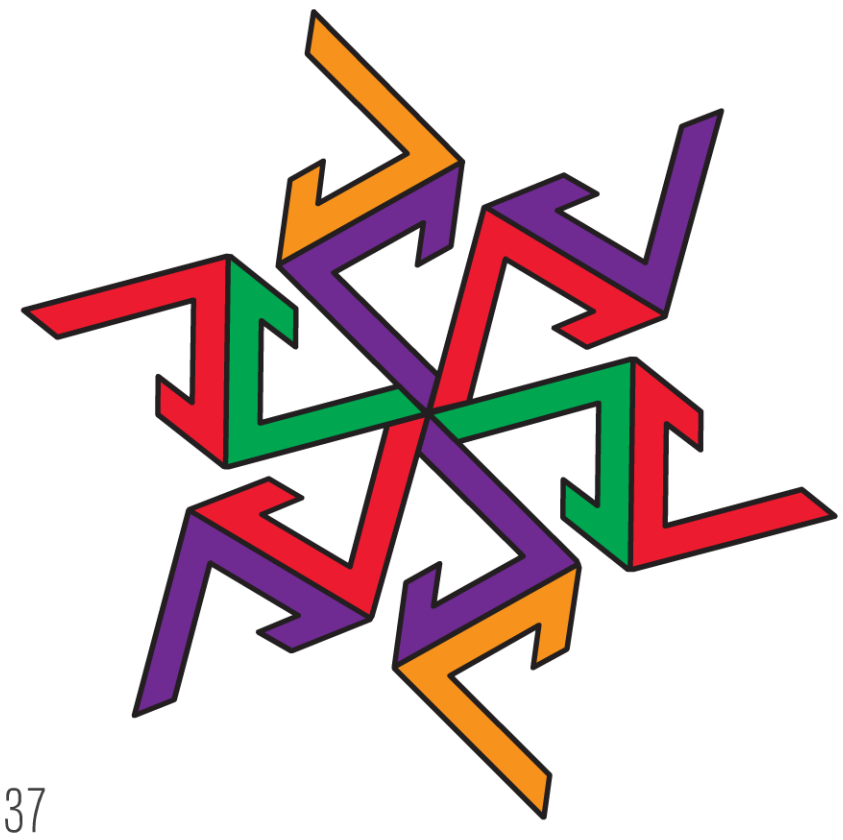

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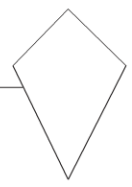

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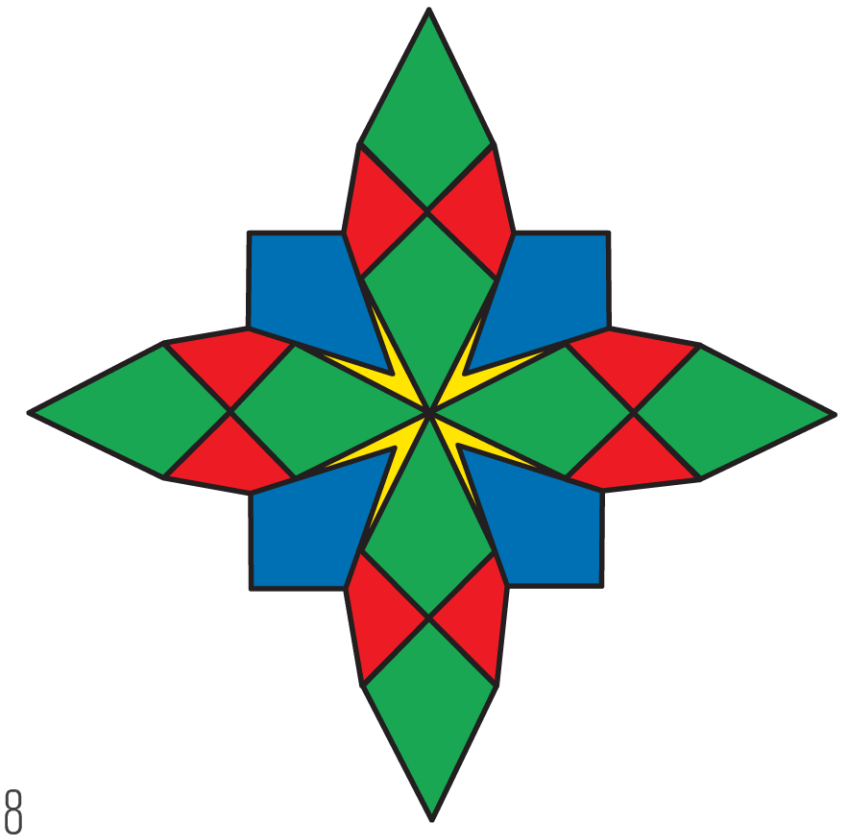

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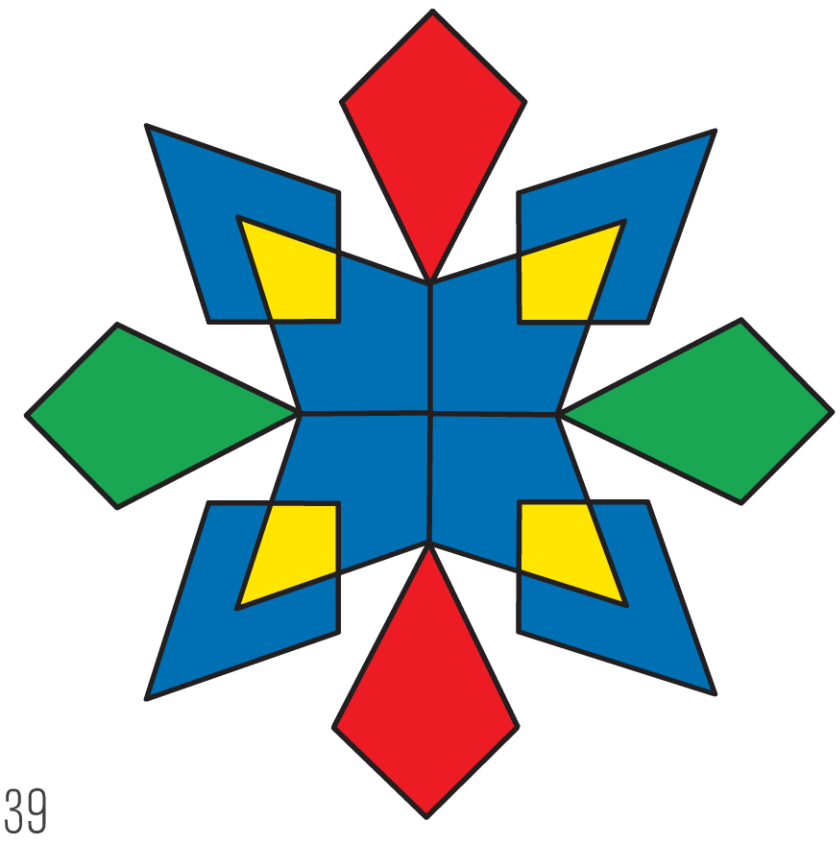

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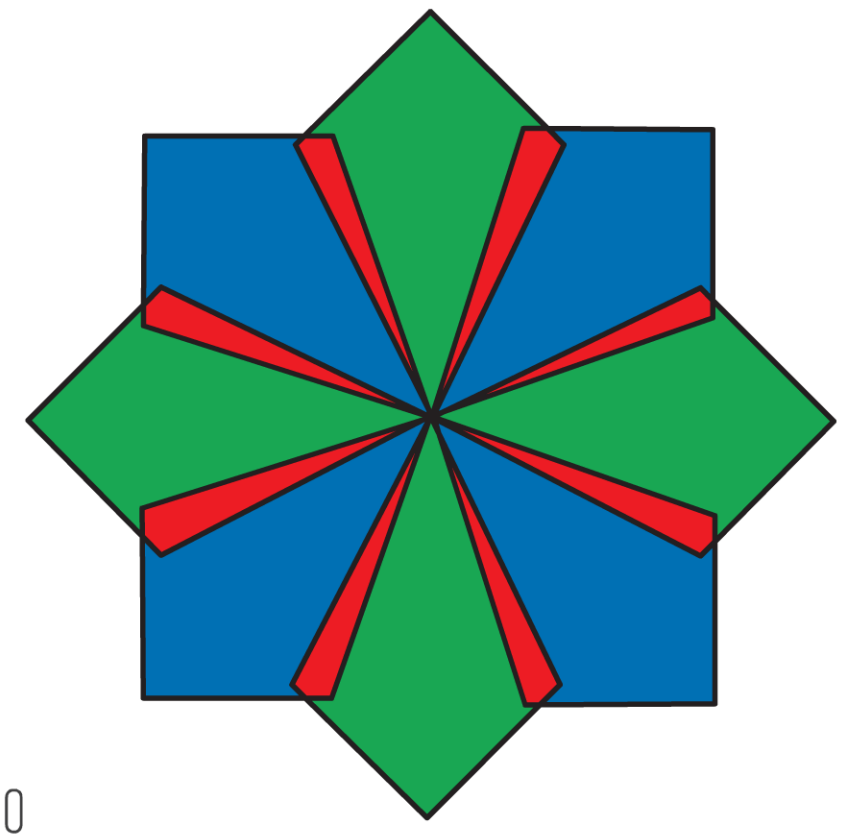

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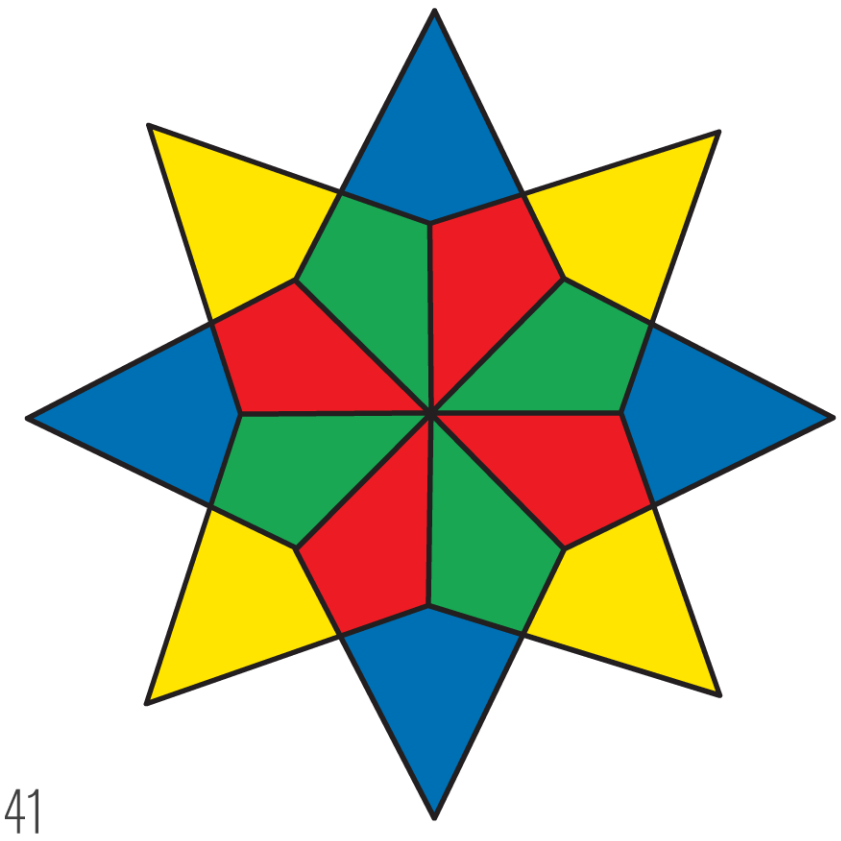

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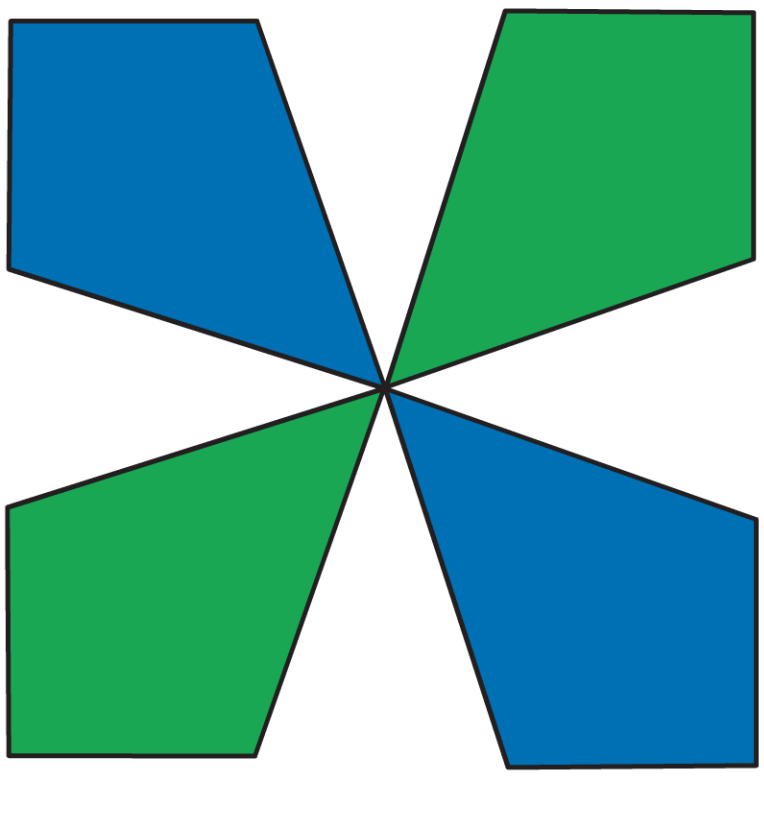

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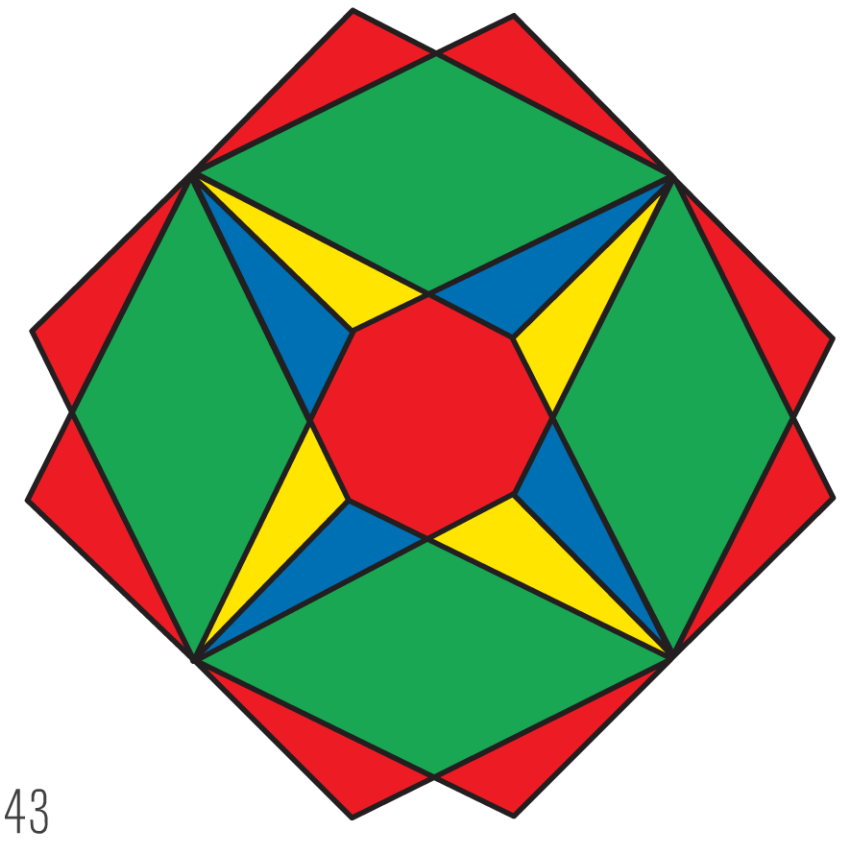

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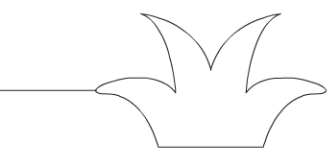

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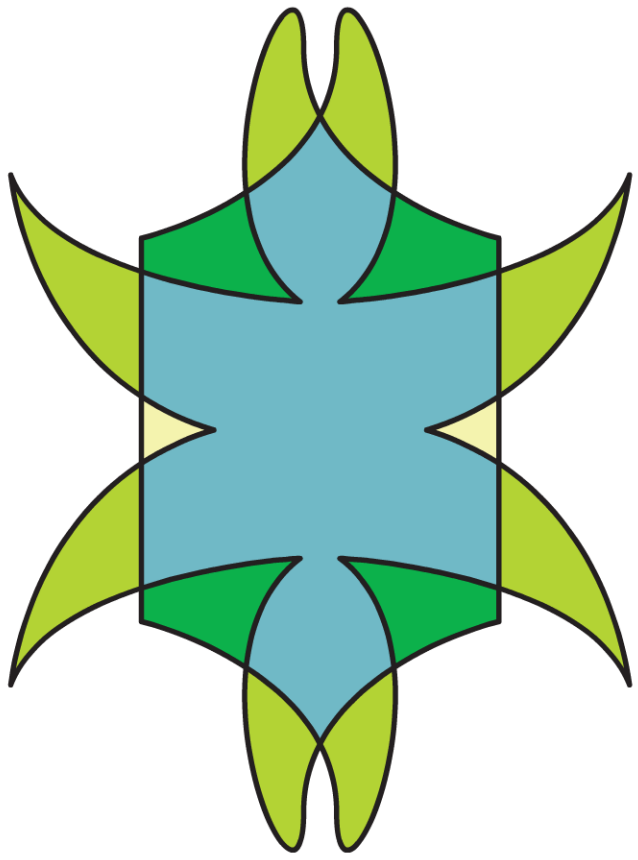

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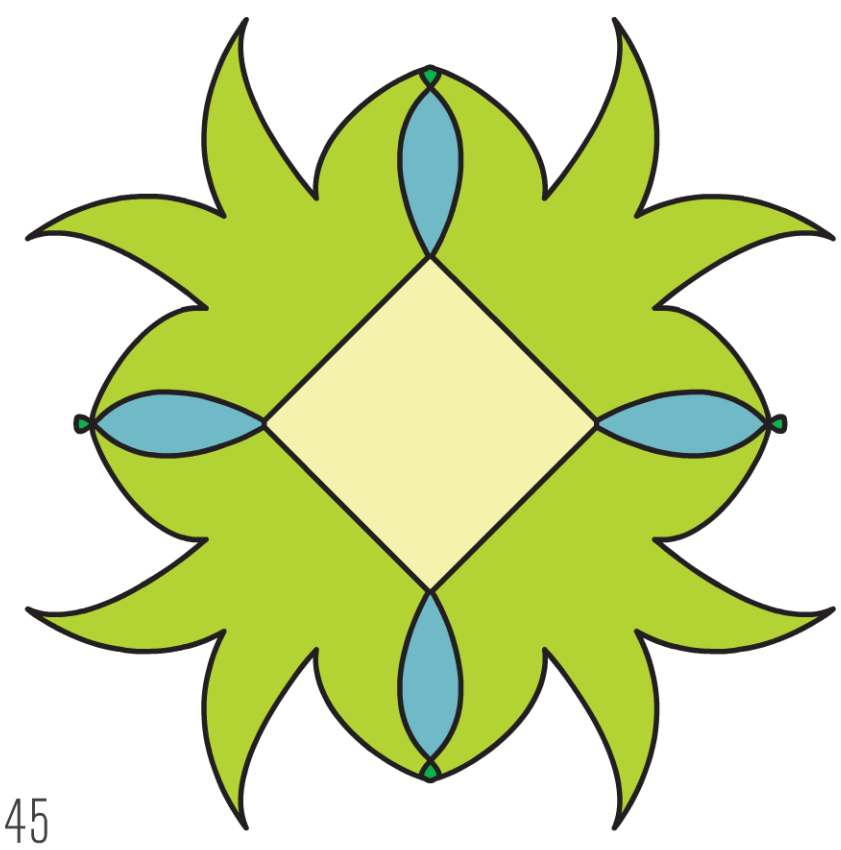

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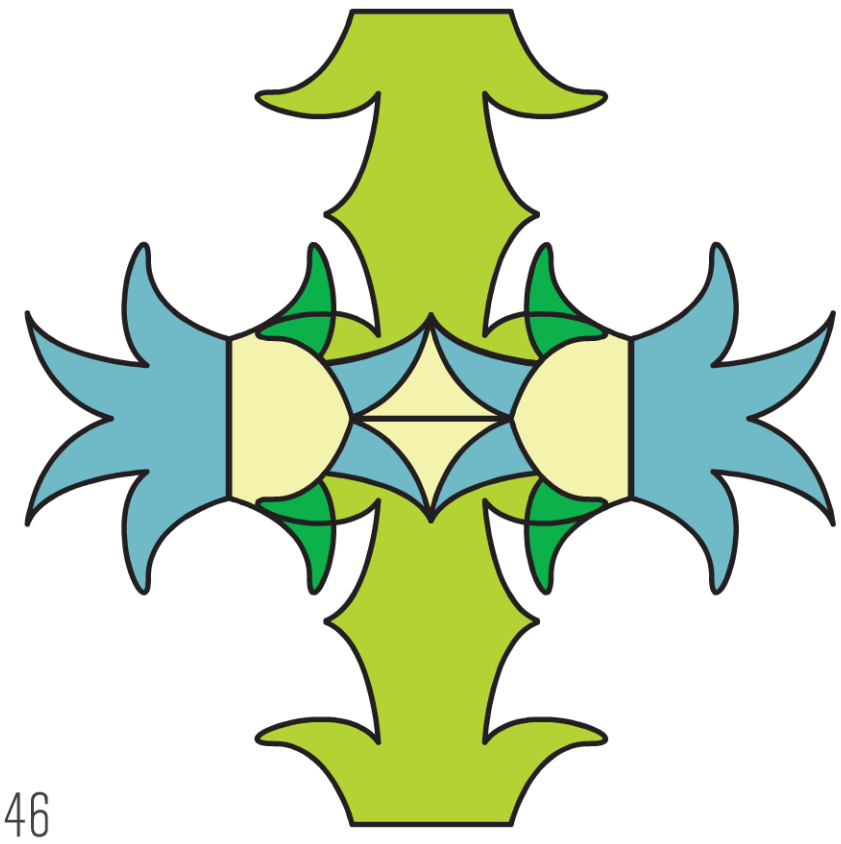

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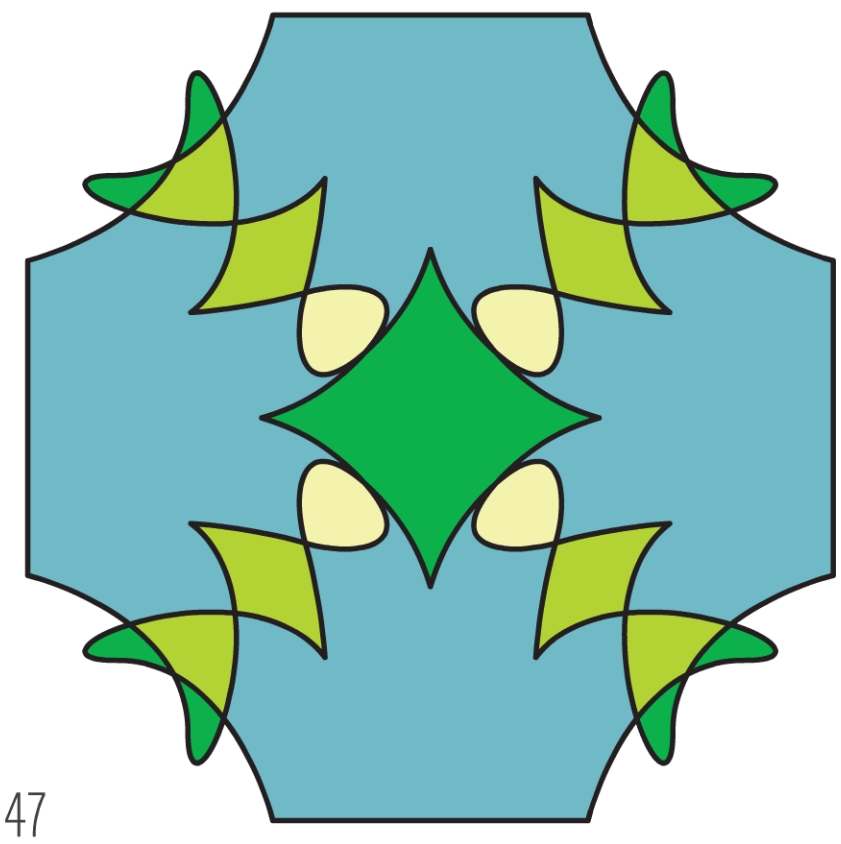

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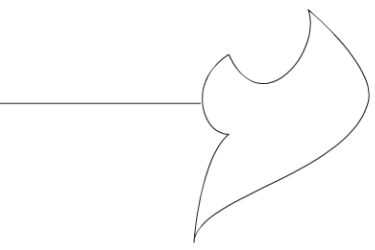

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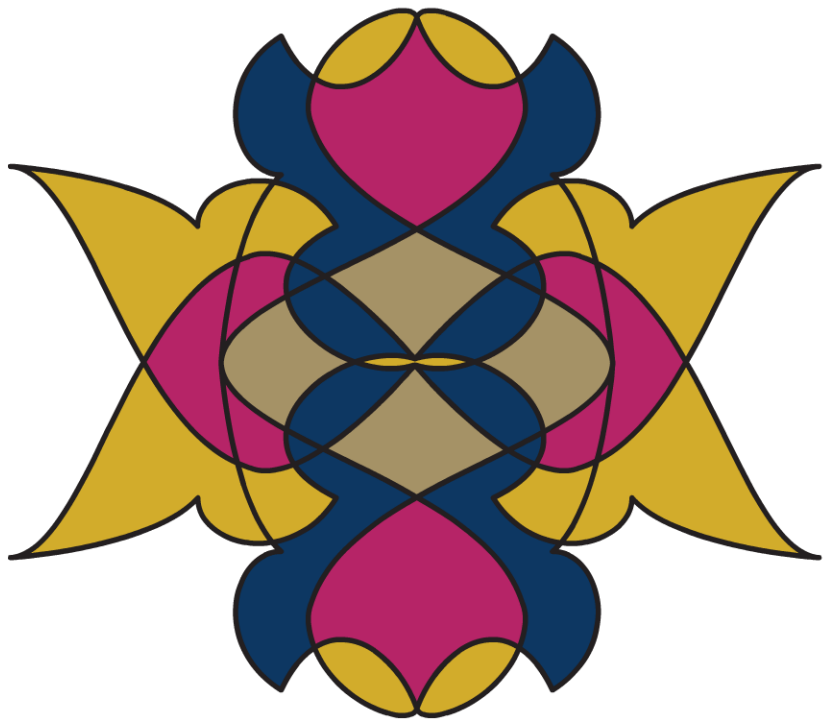

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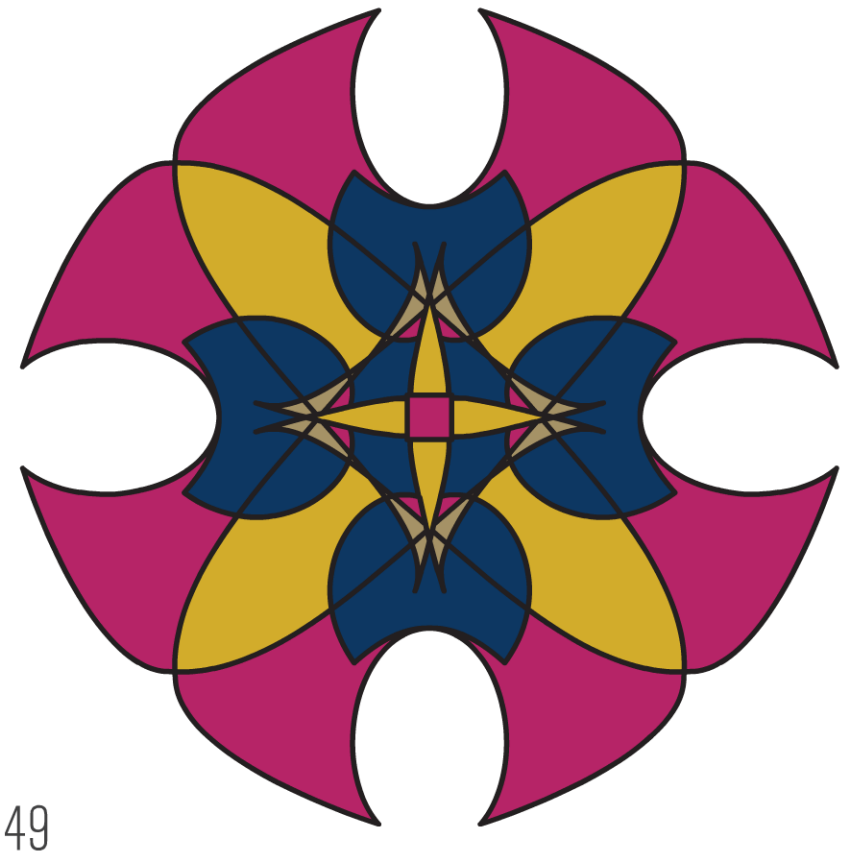

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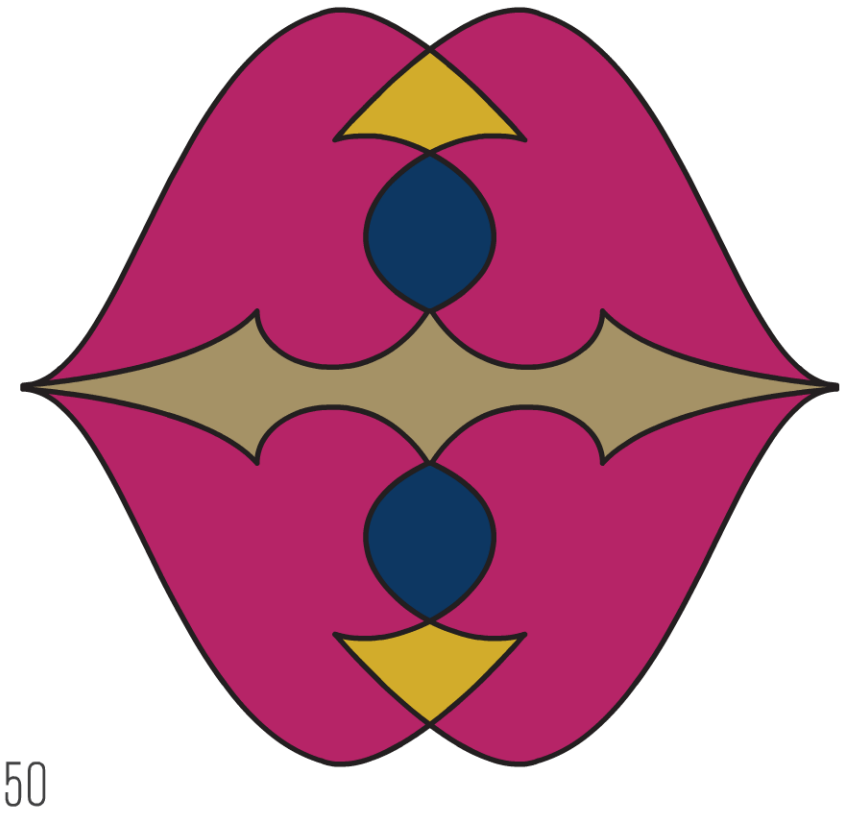

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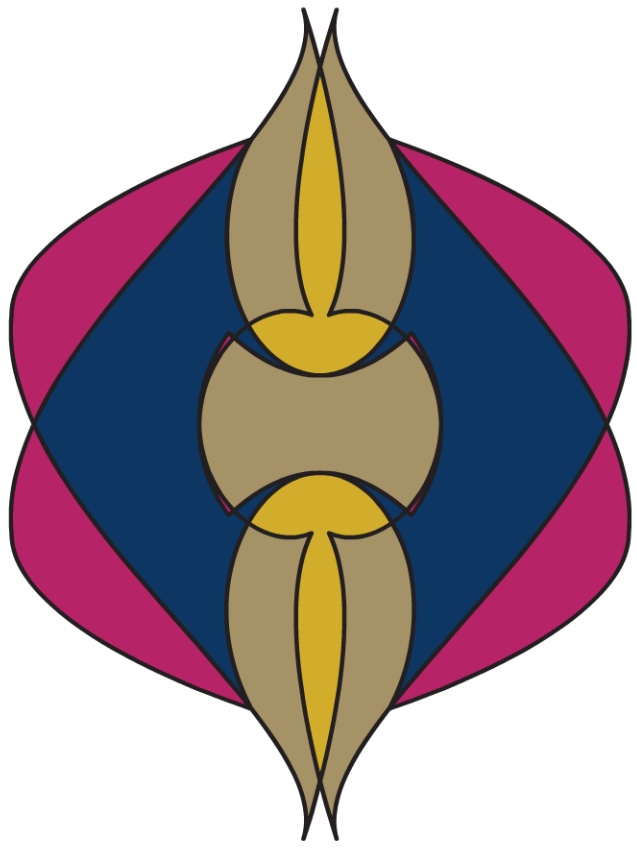

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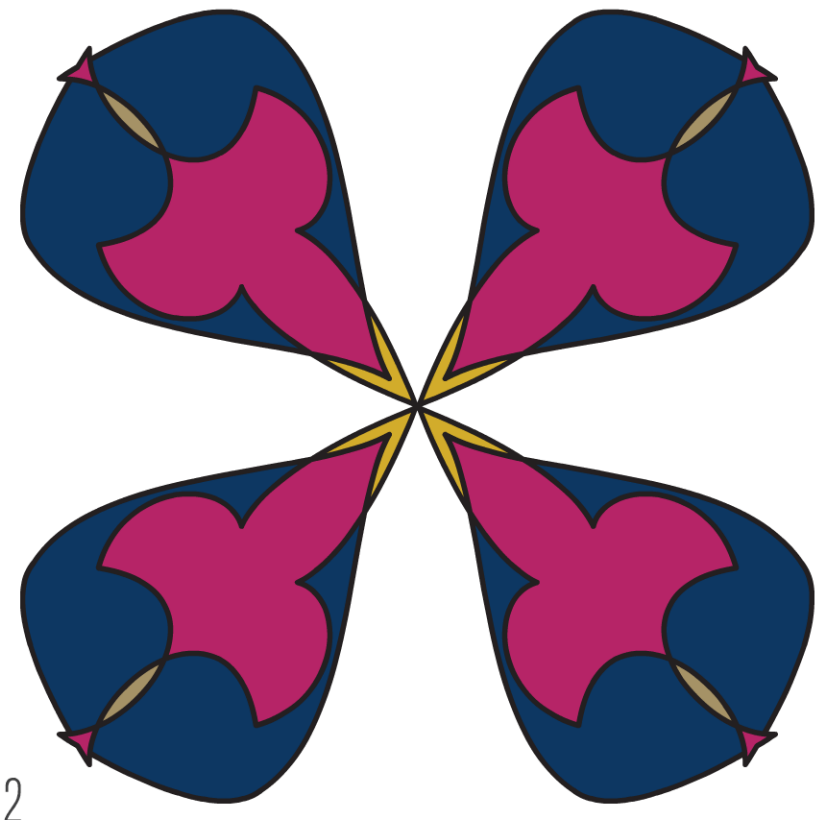

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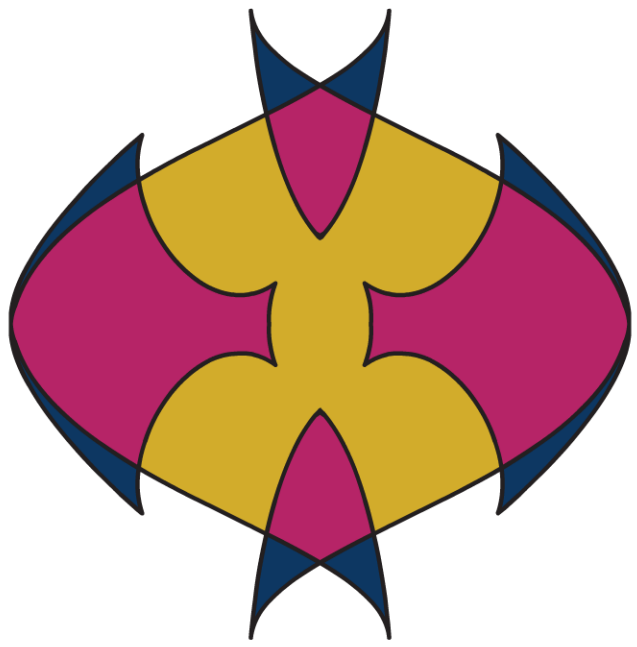

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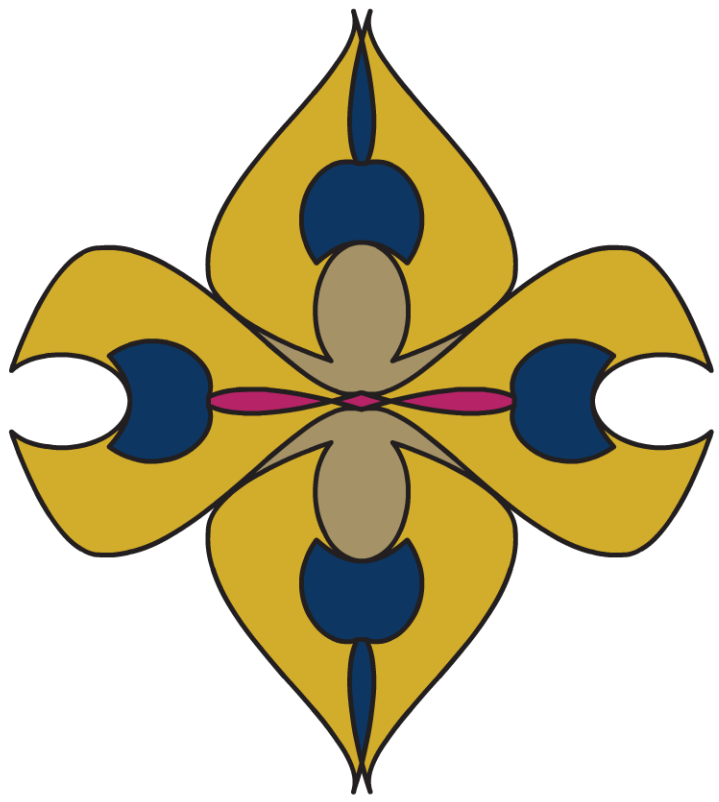

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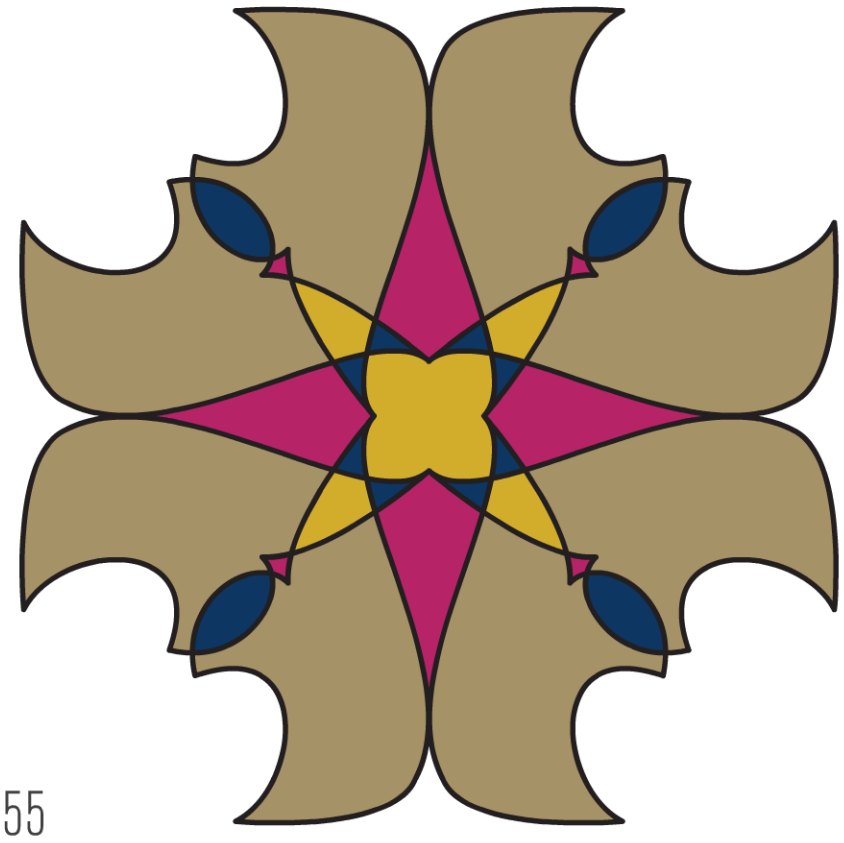

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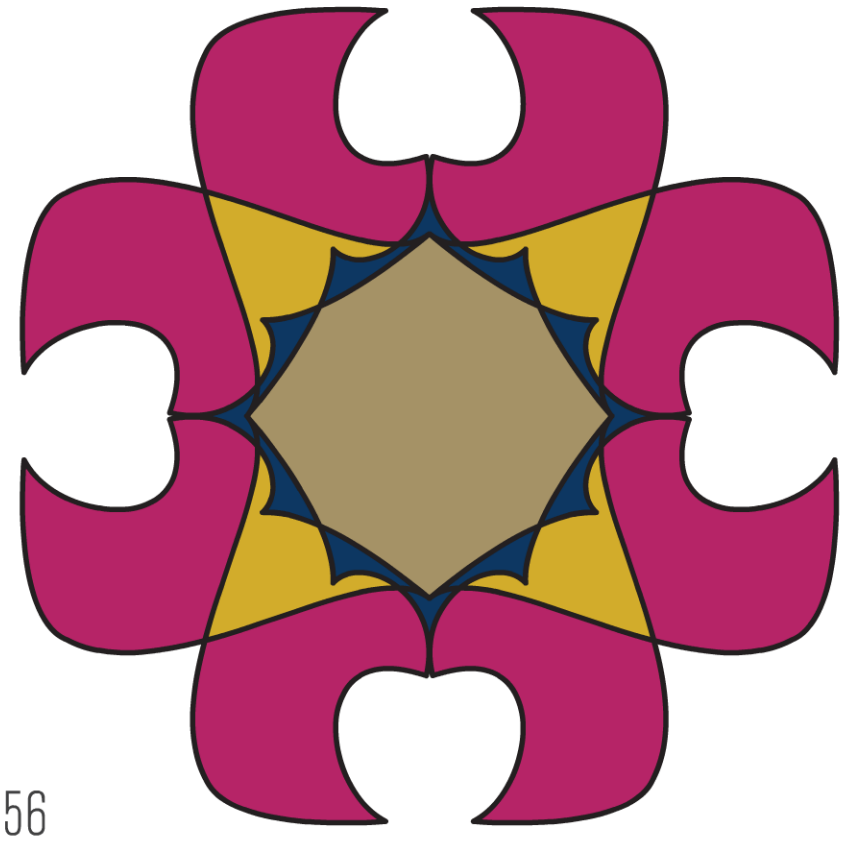

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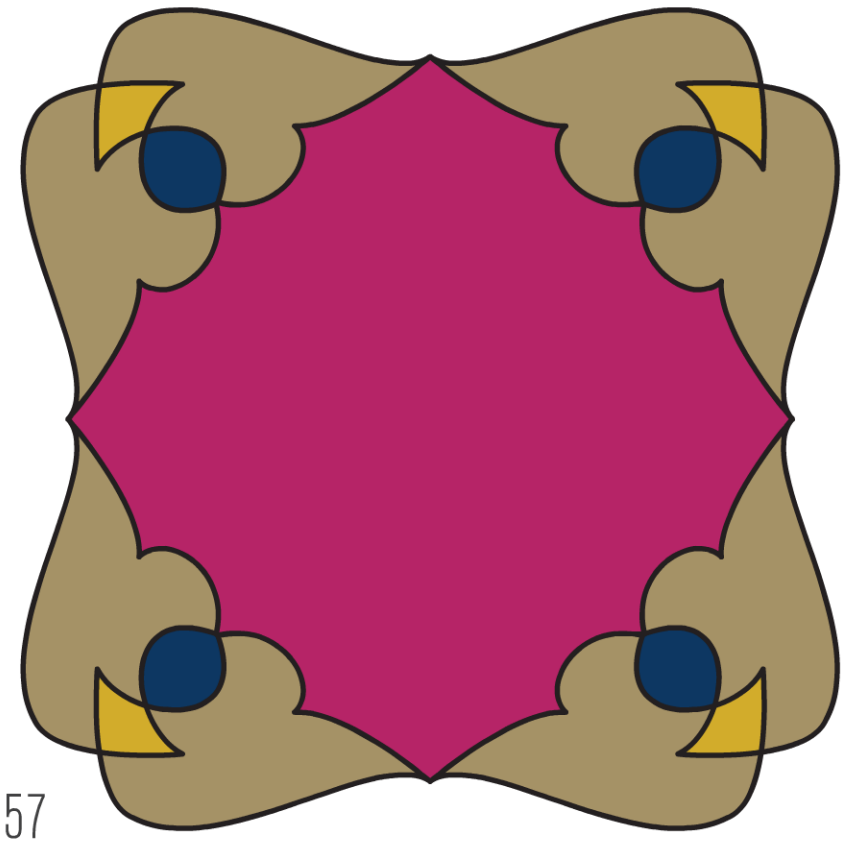

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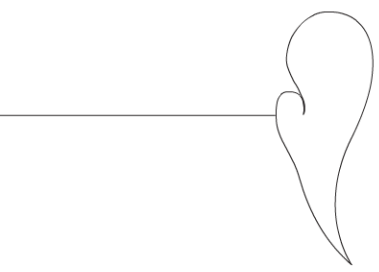
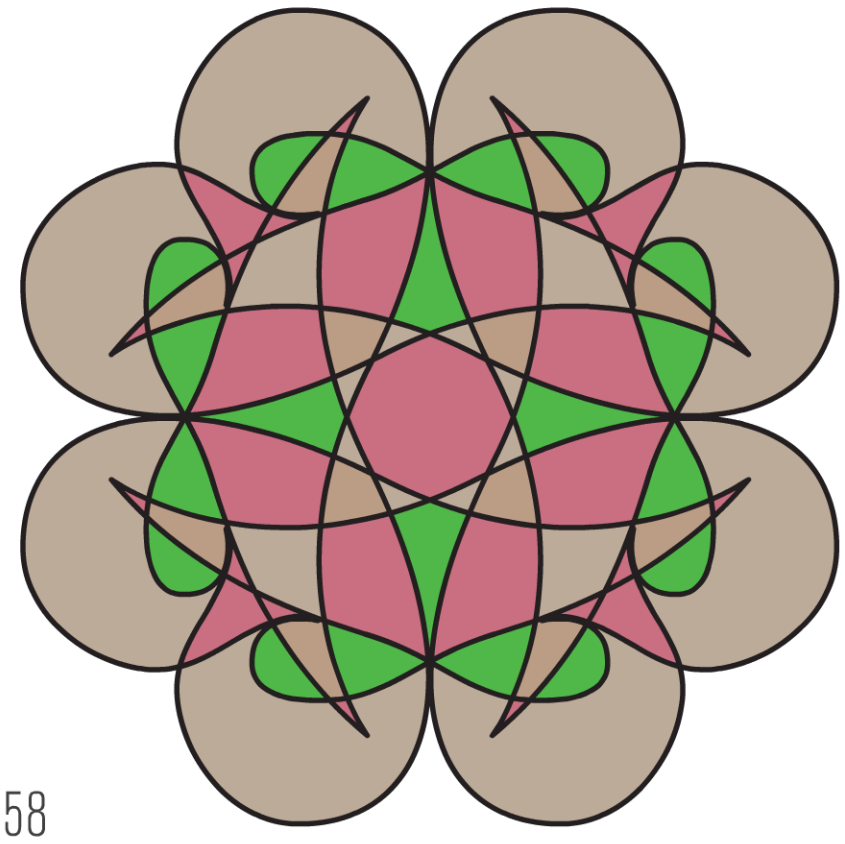


Leaf Petal 3



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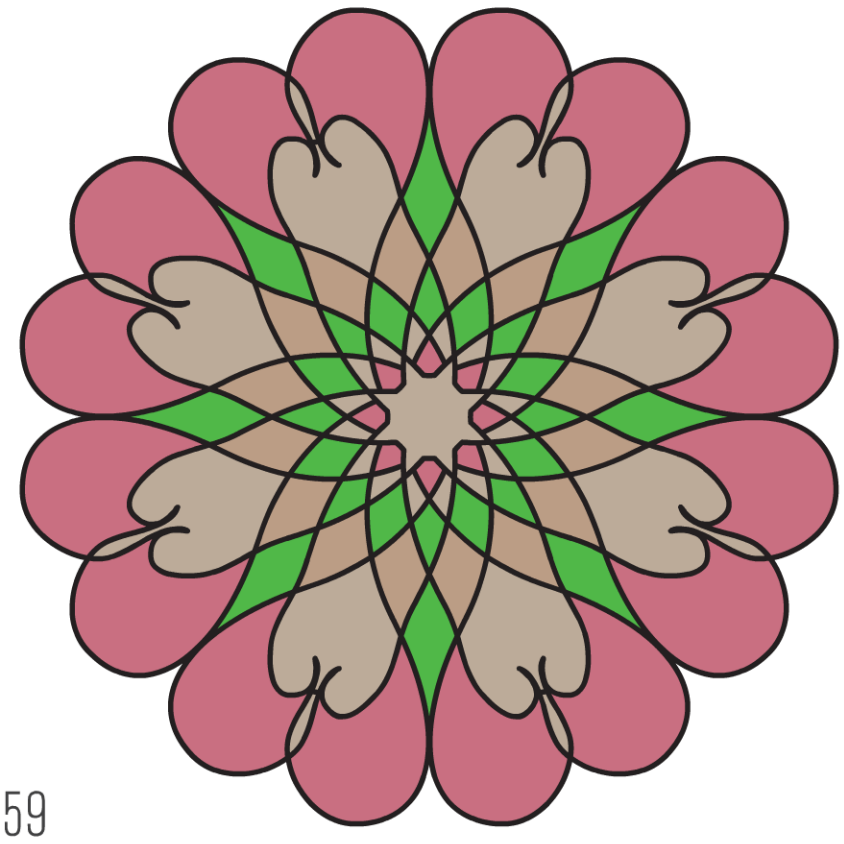

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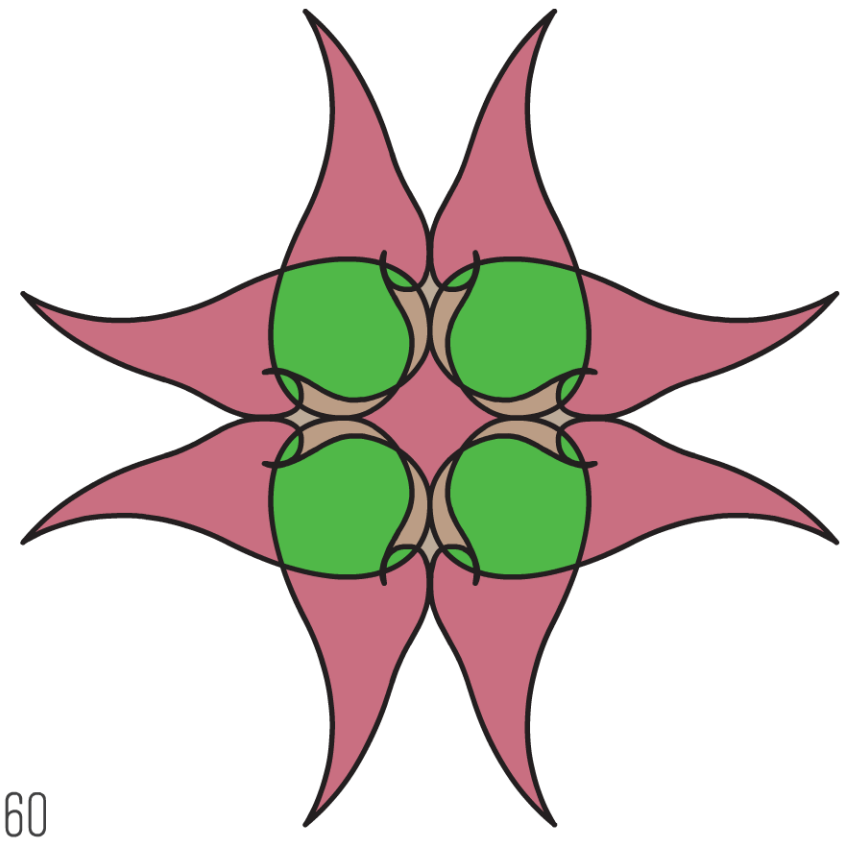

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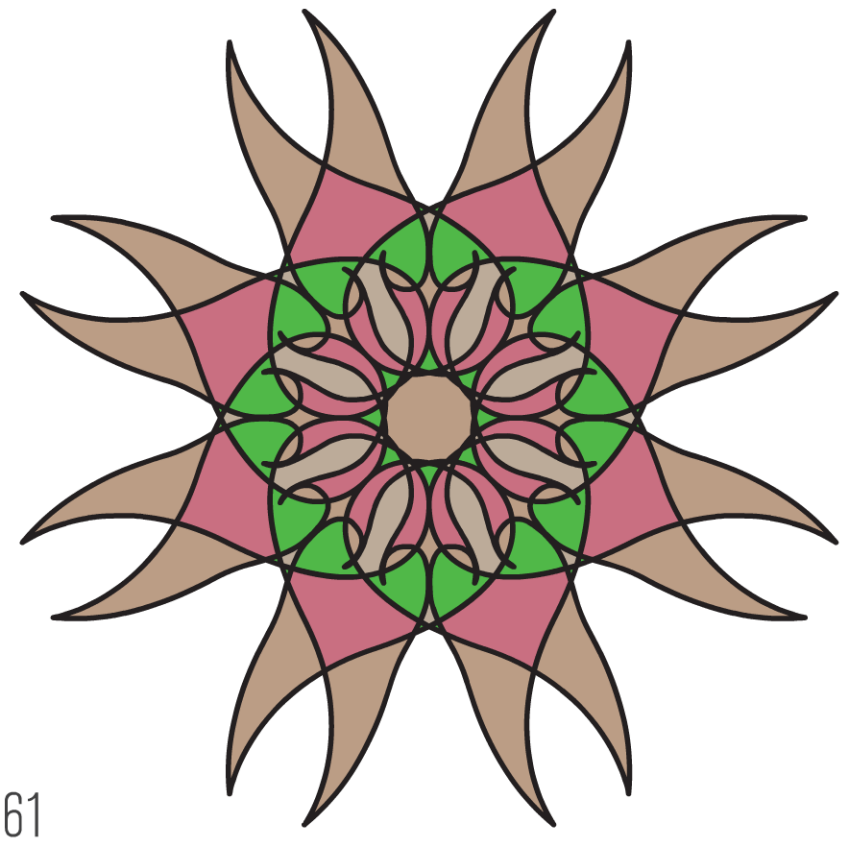

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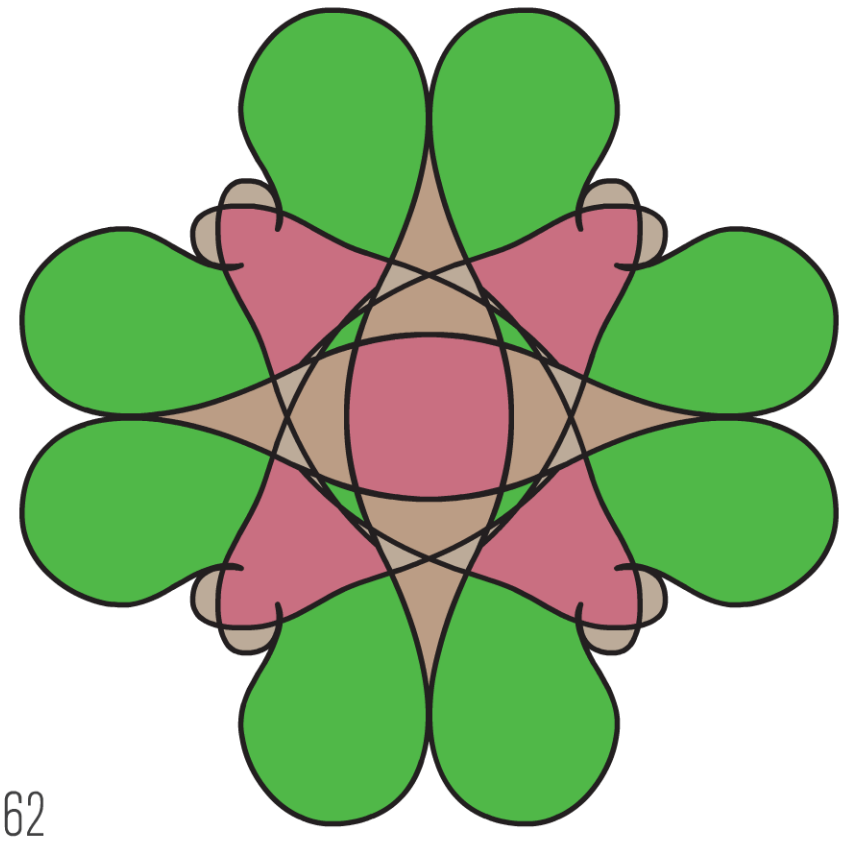

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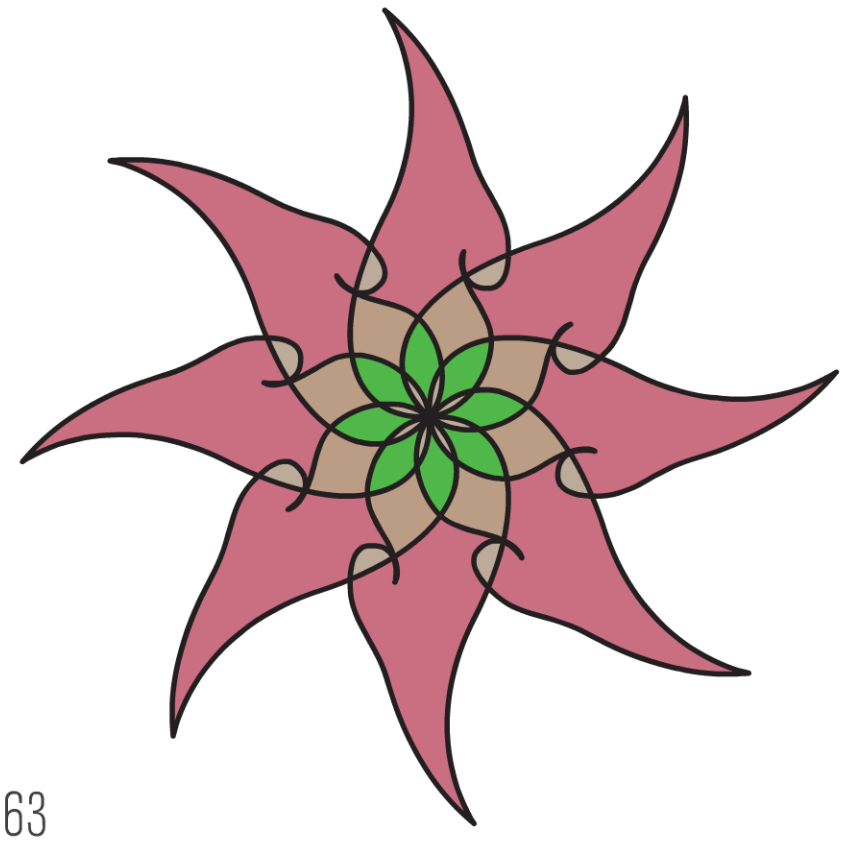

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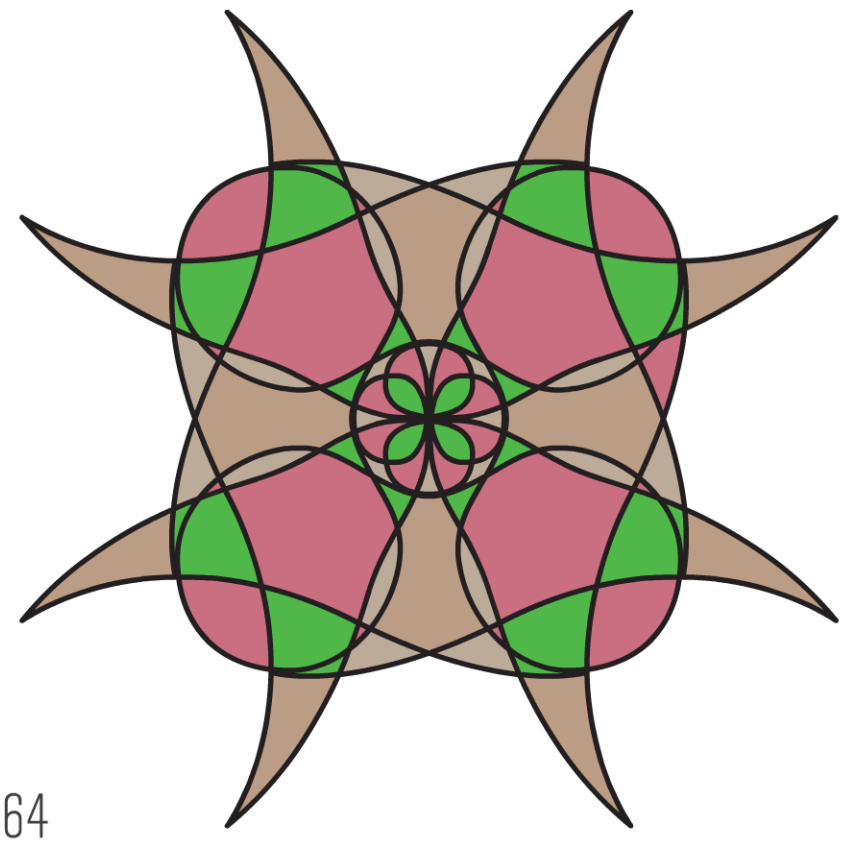

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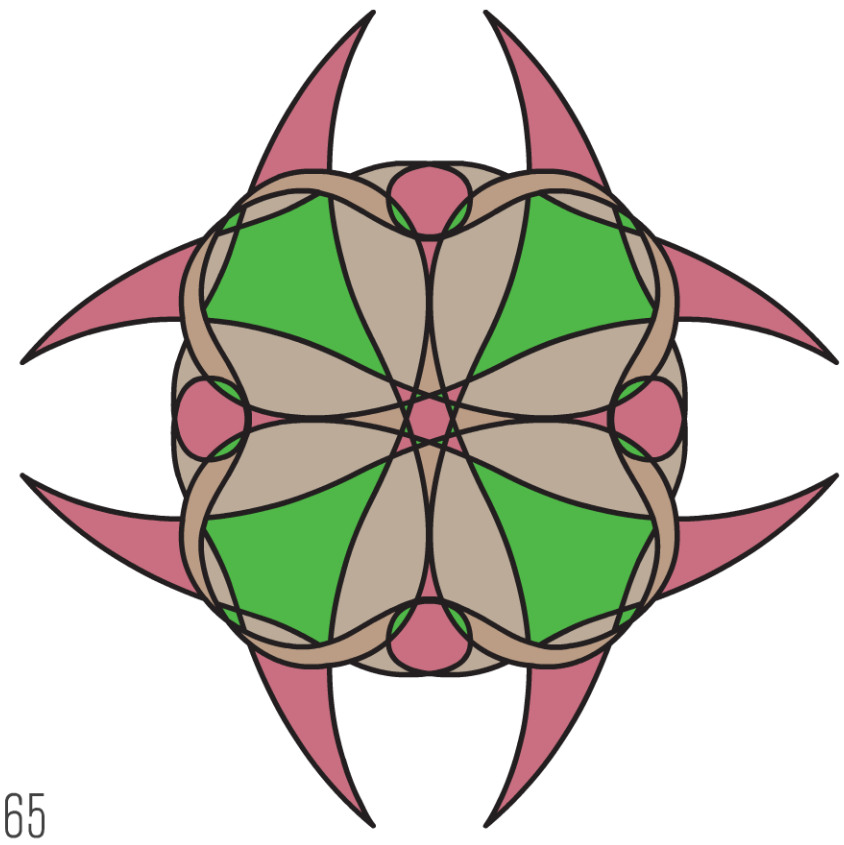

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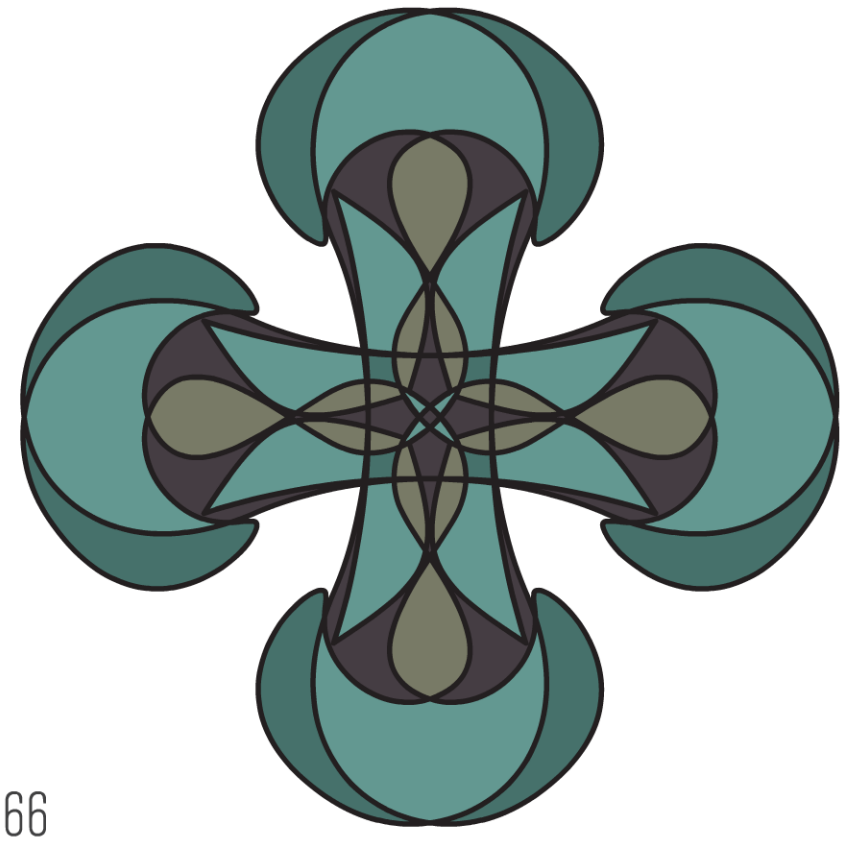

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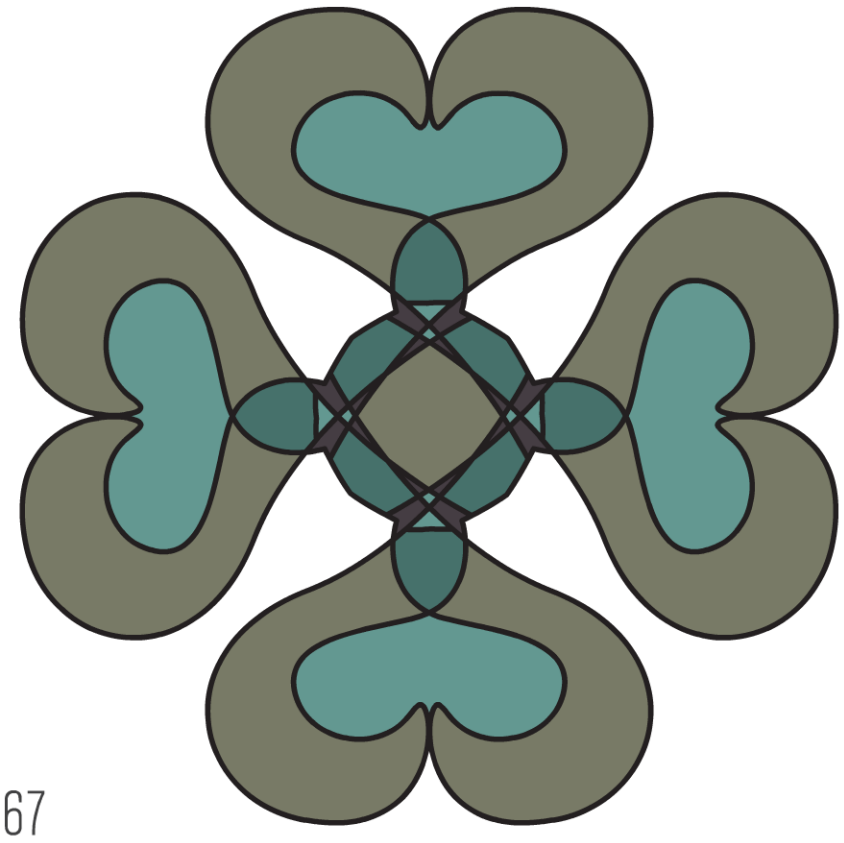

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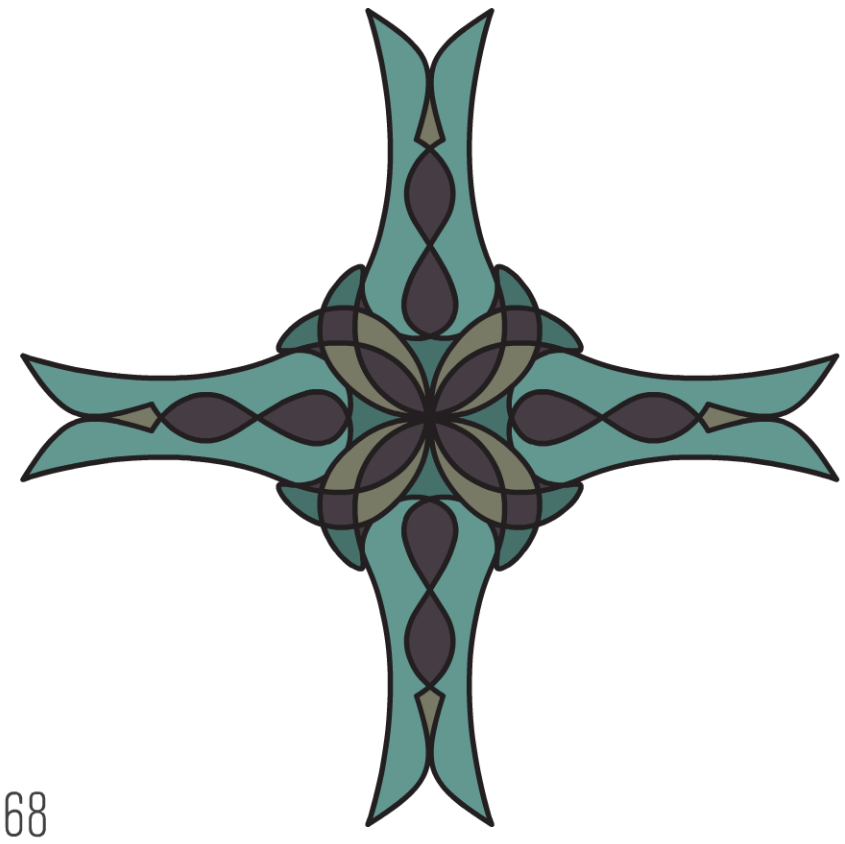

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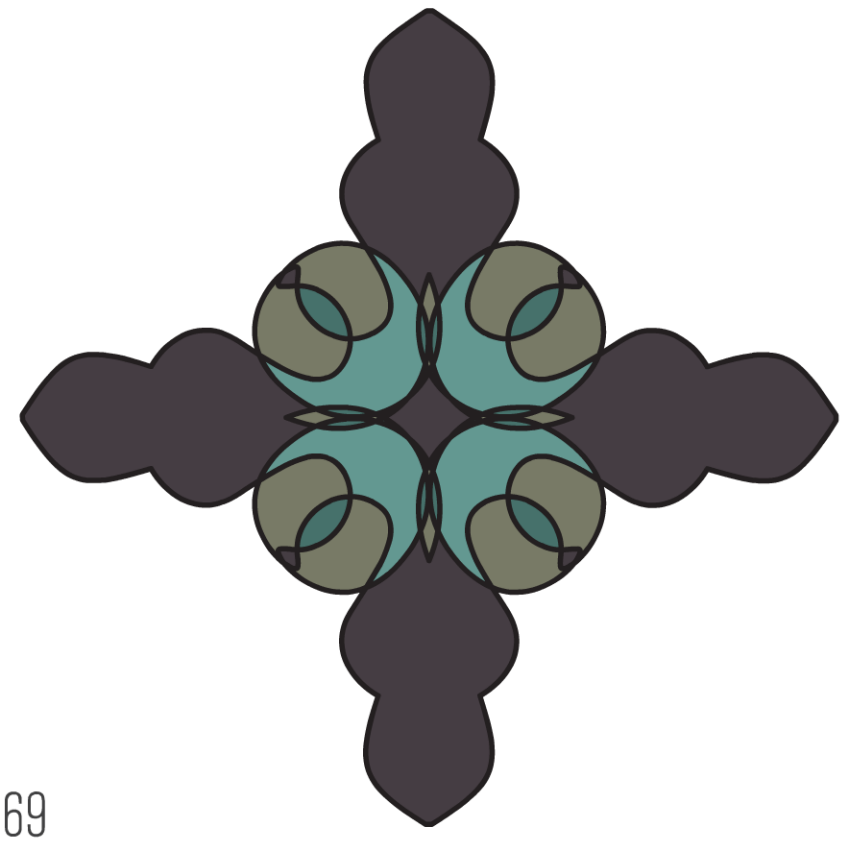

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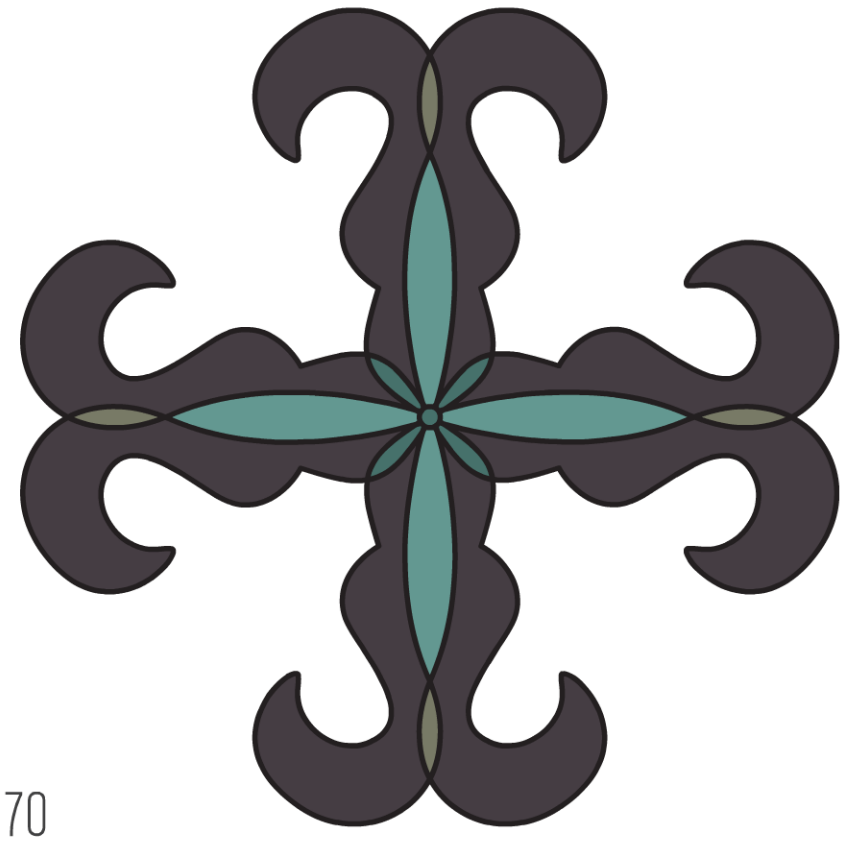

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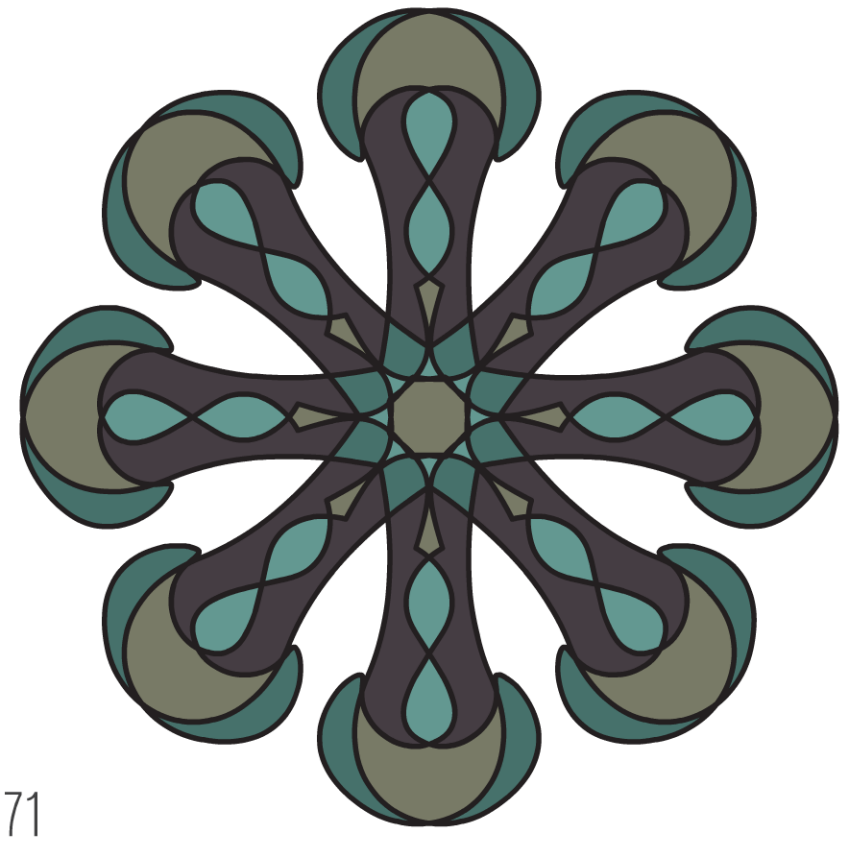

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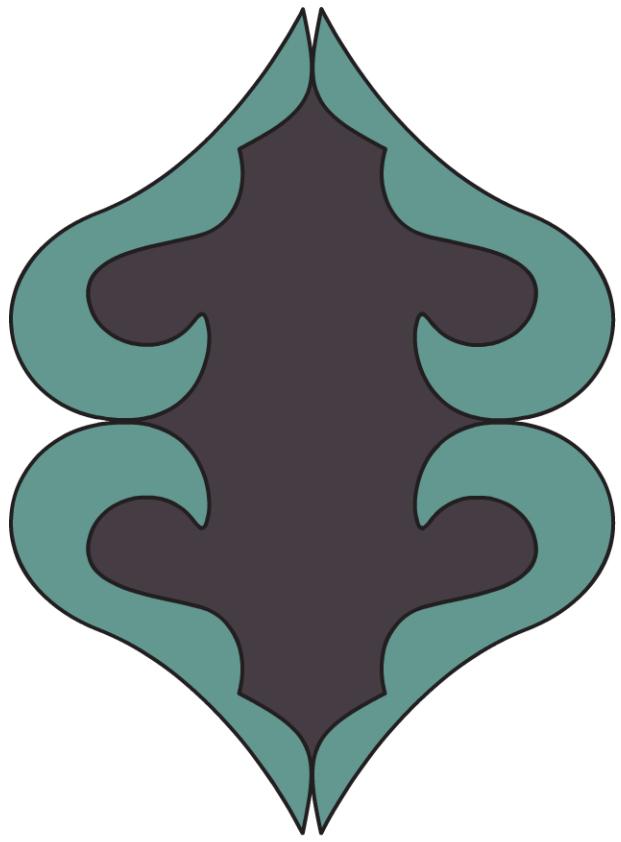

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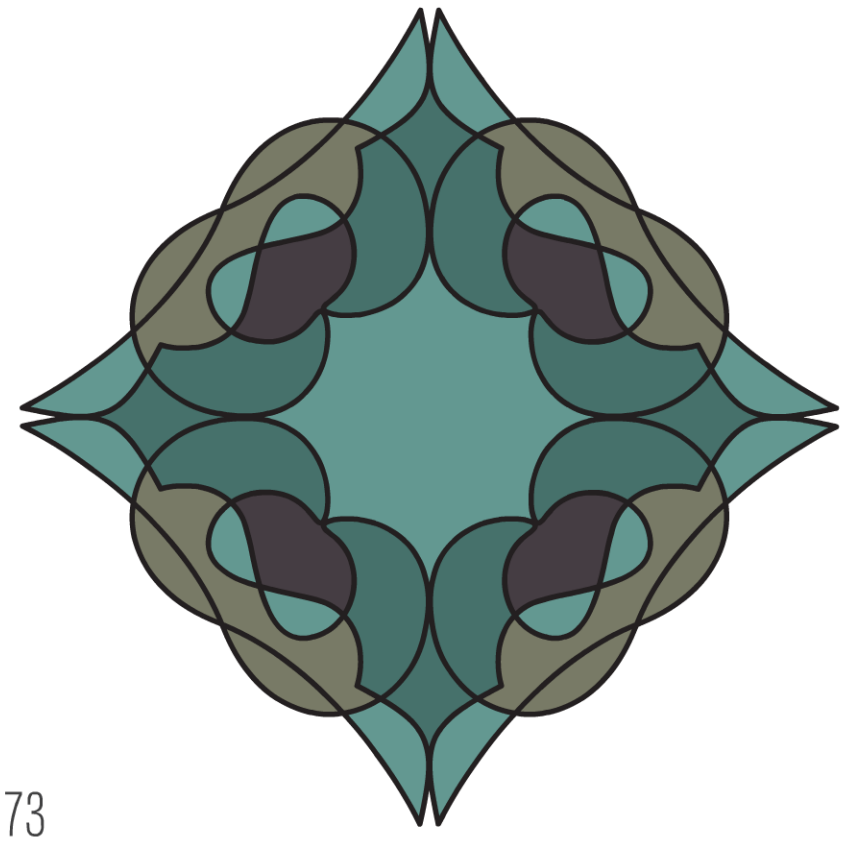

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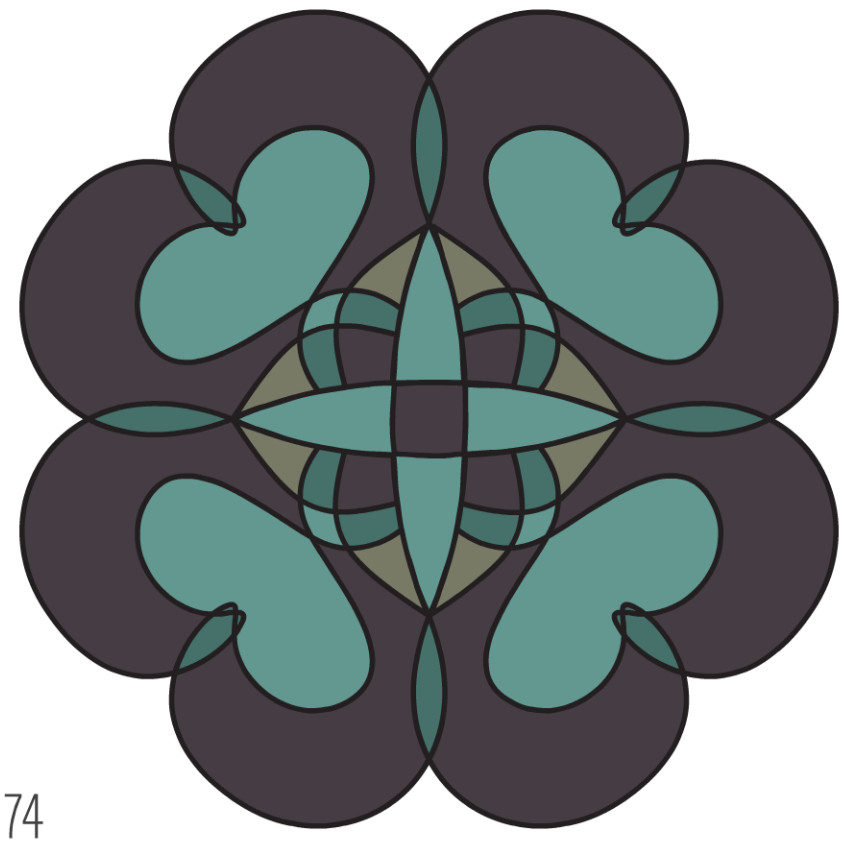

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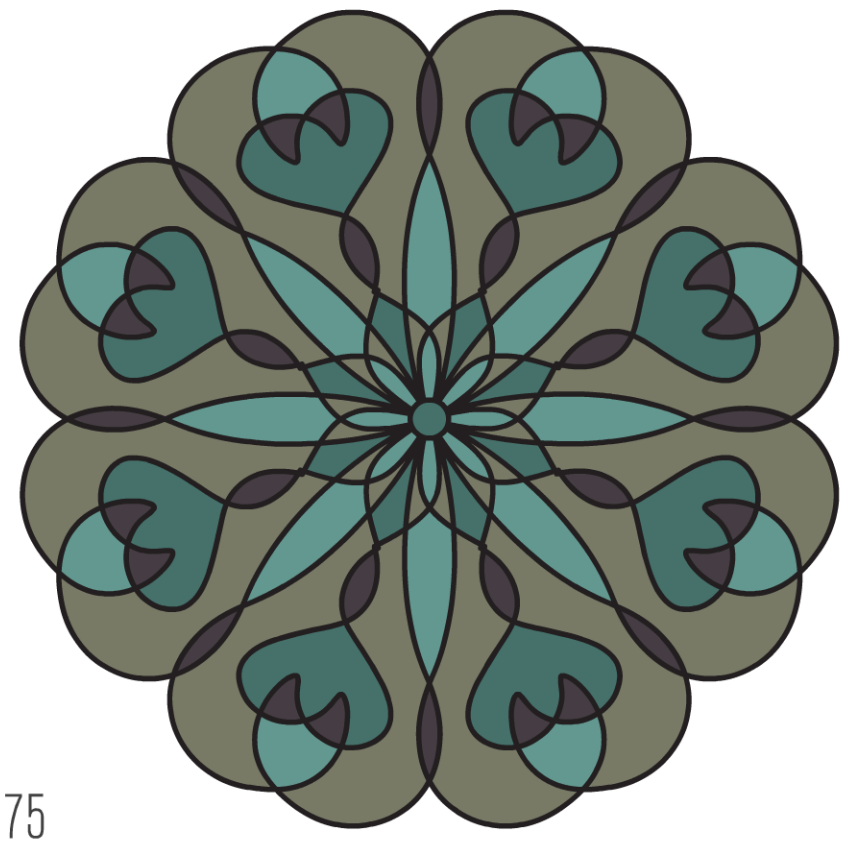

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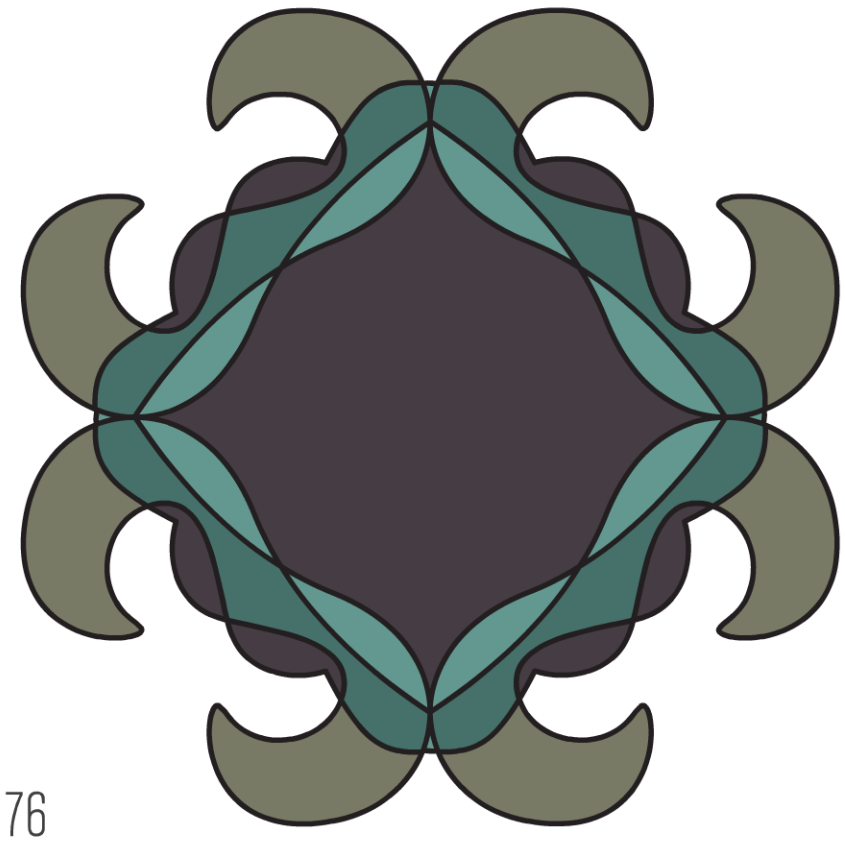

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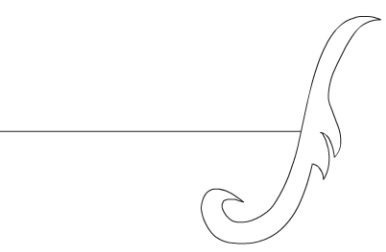

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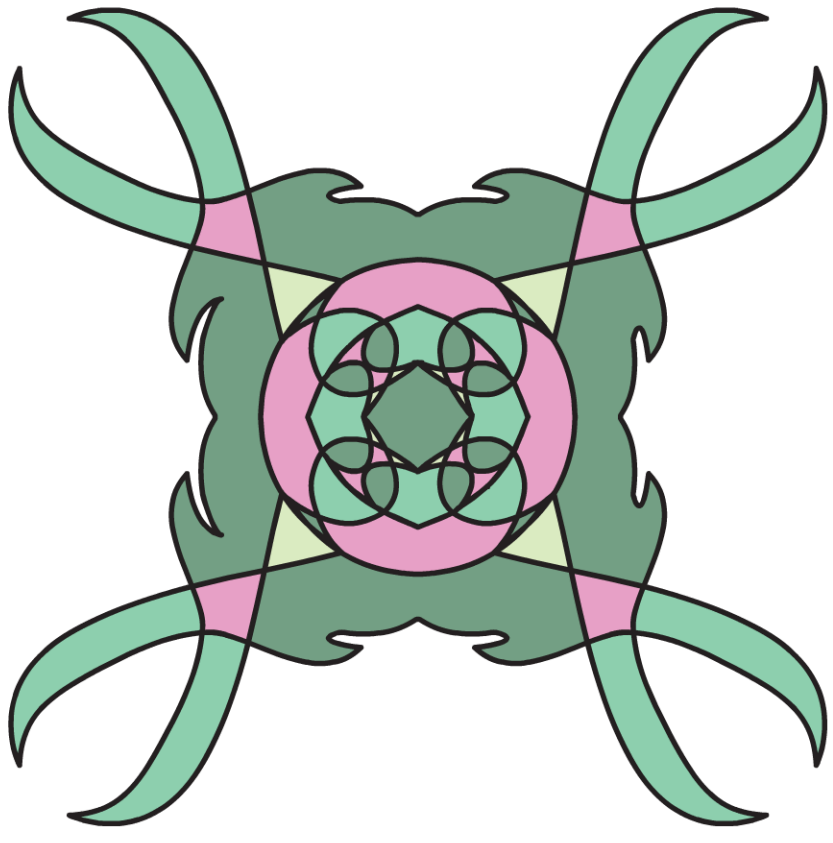

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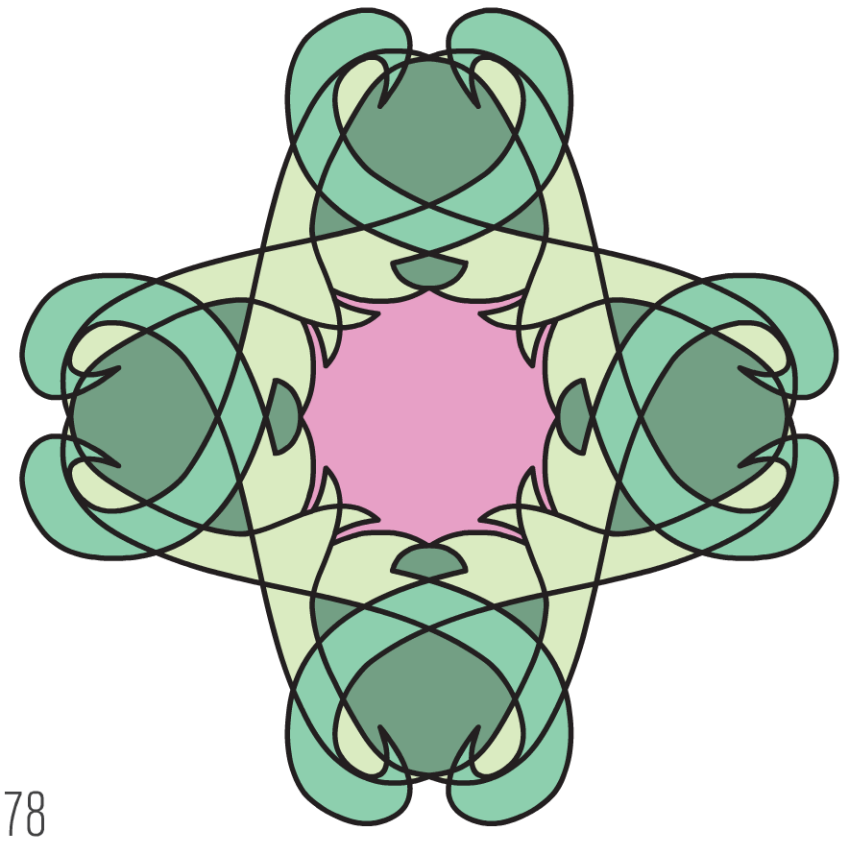

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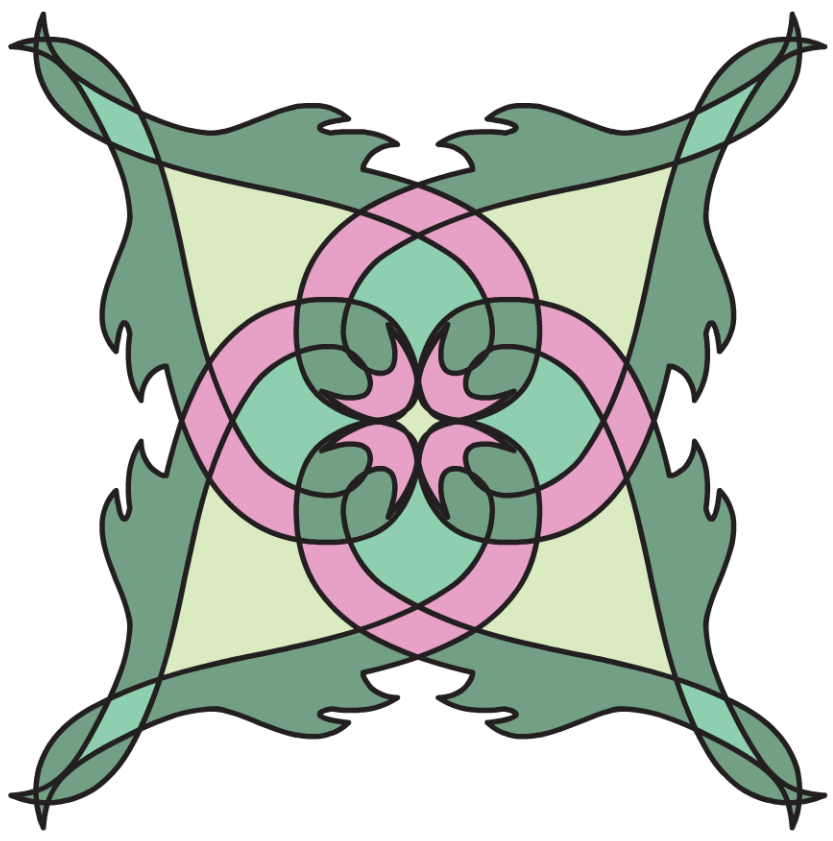

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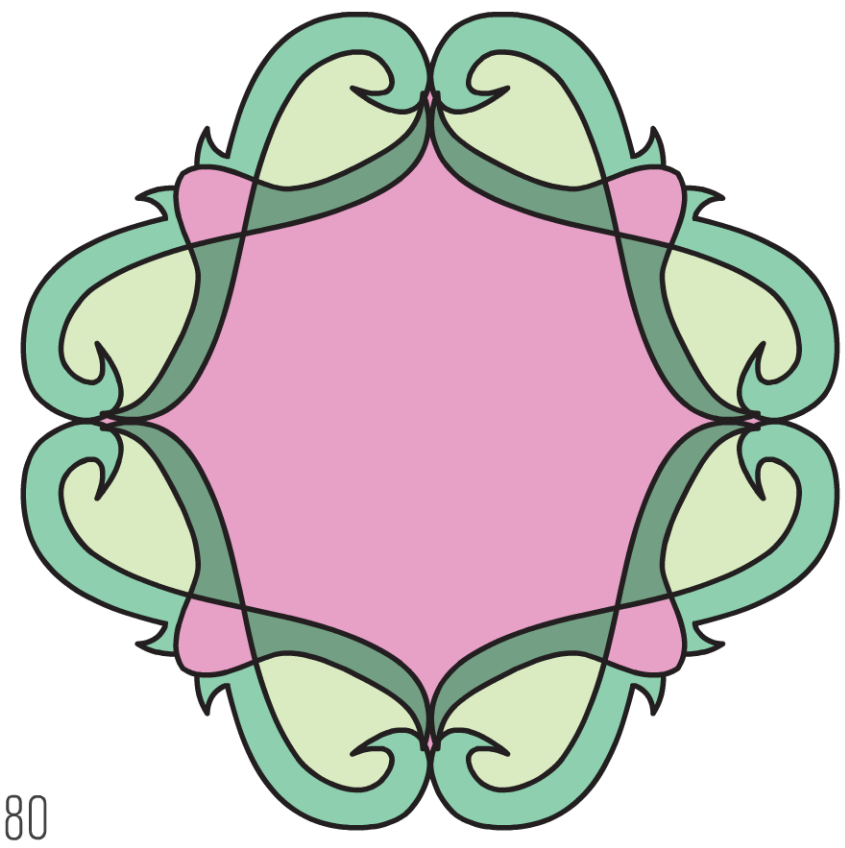

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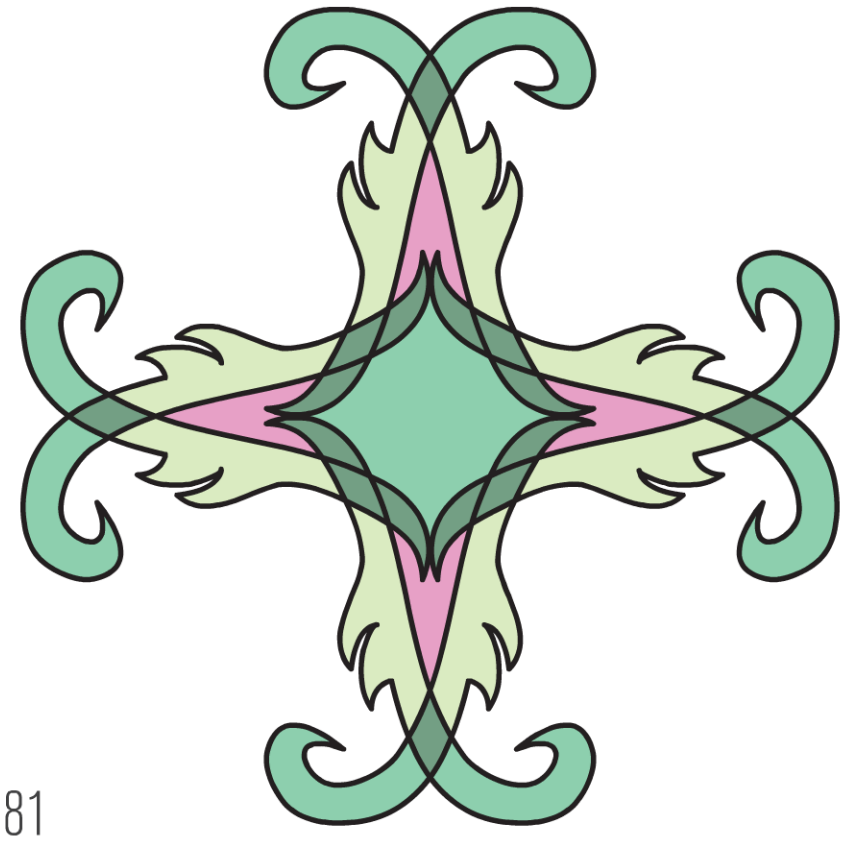

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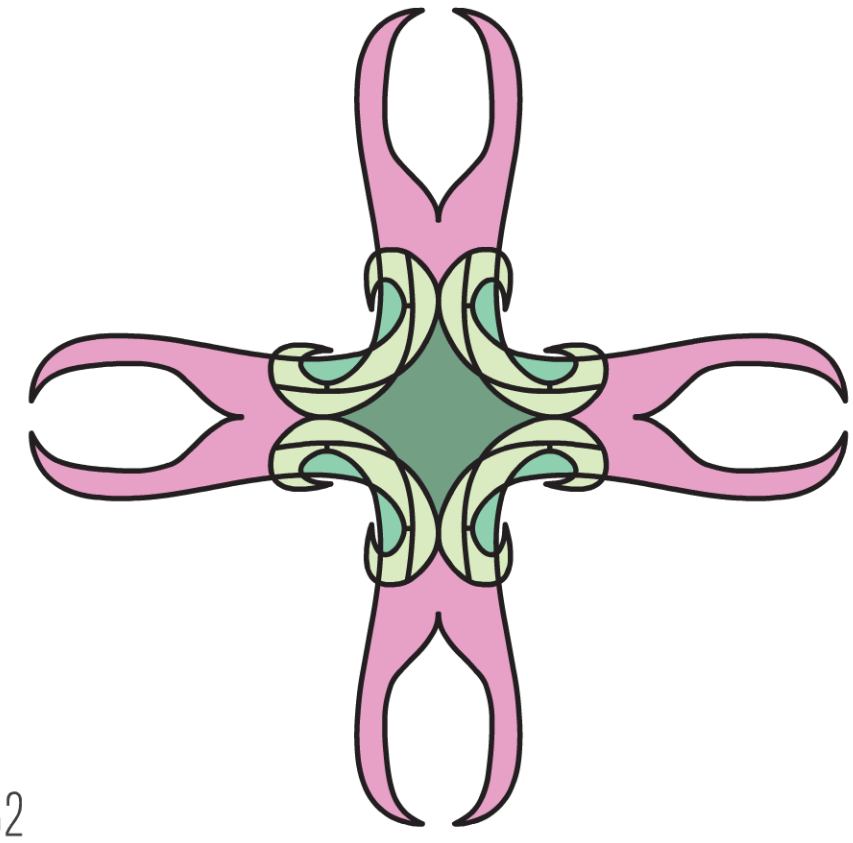

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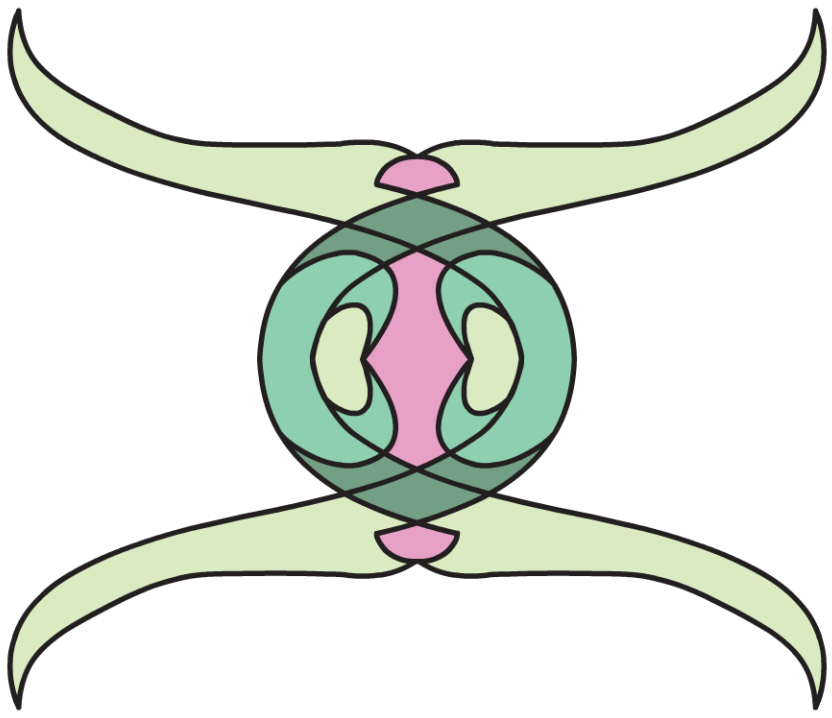

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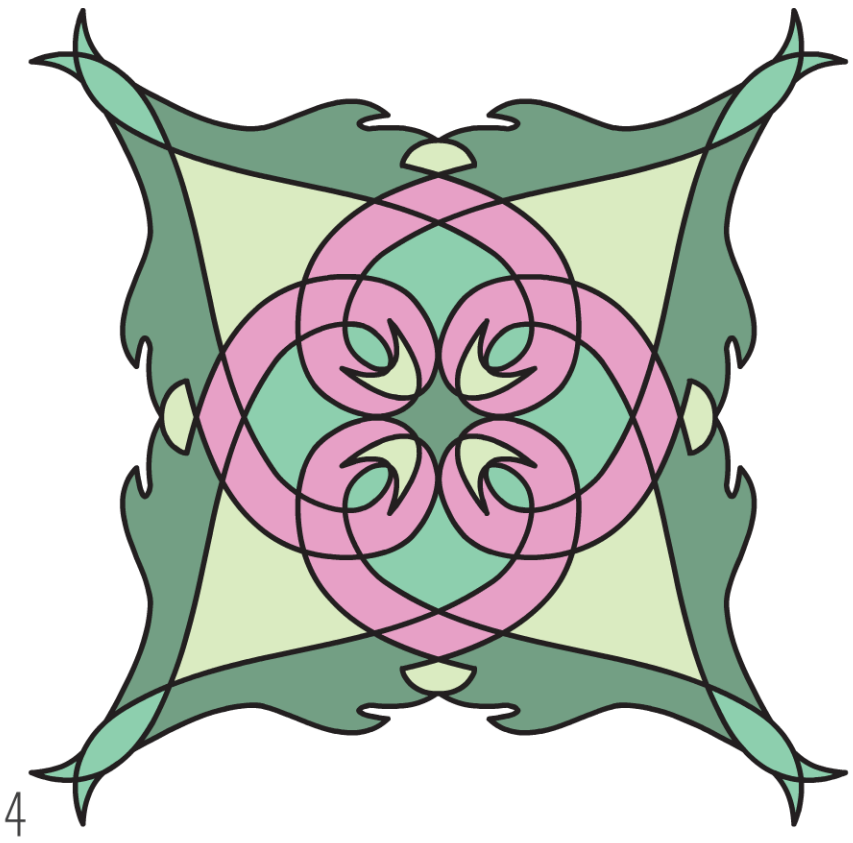

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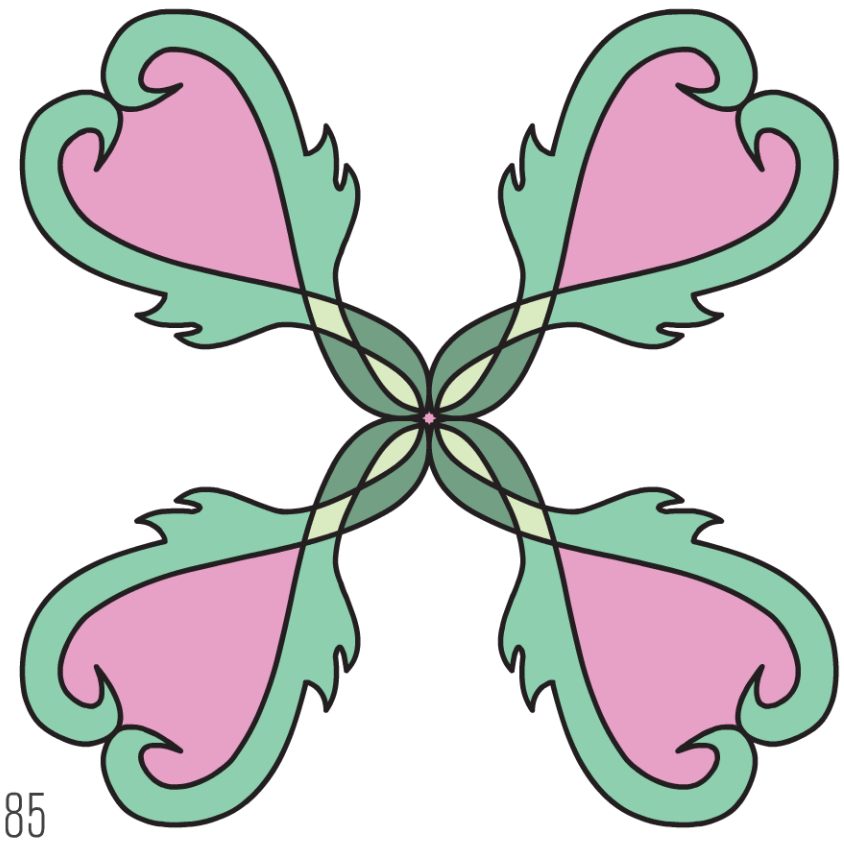

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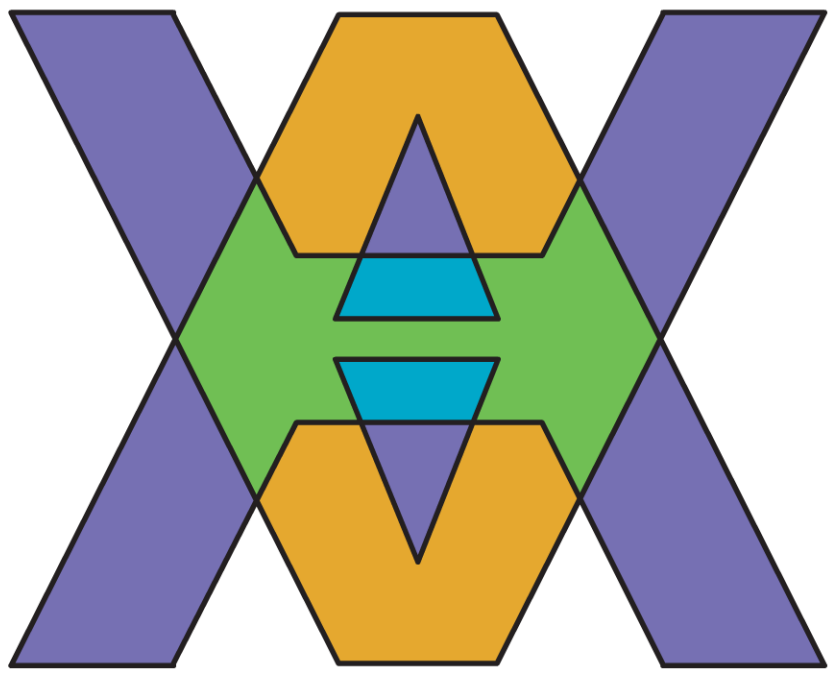

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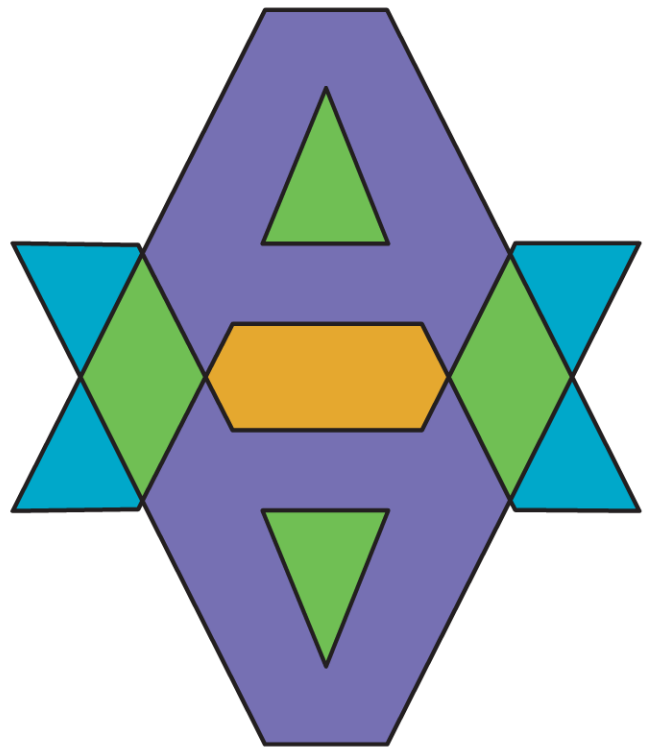

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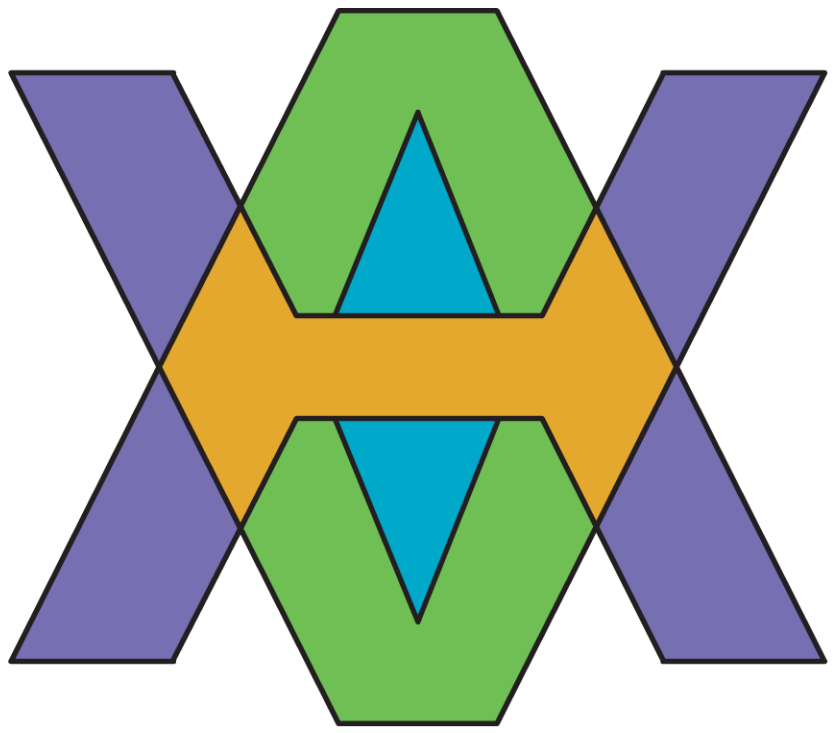

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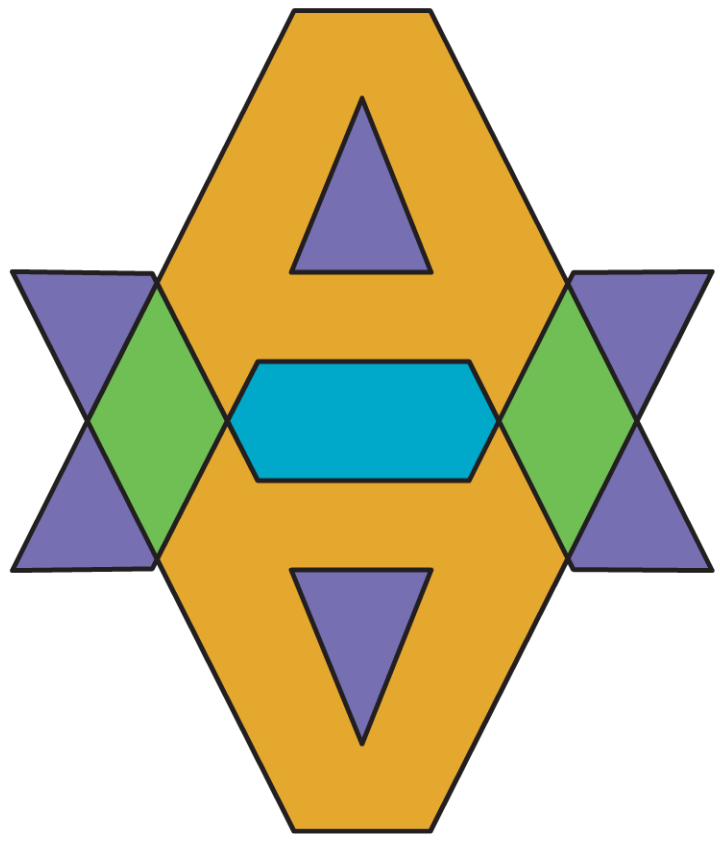

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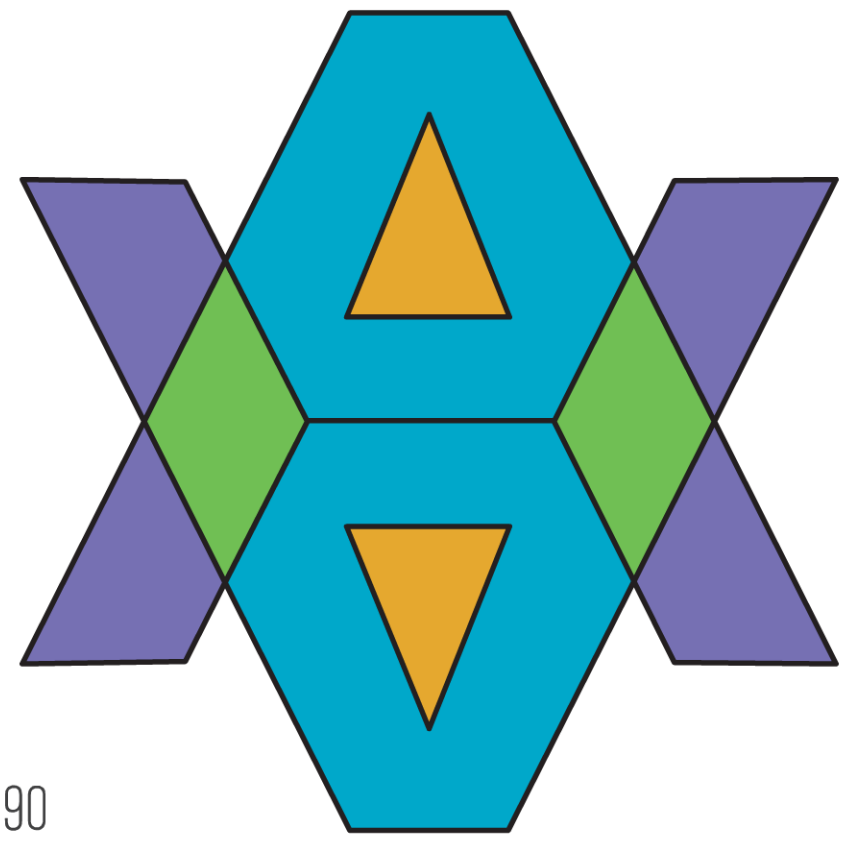

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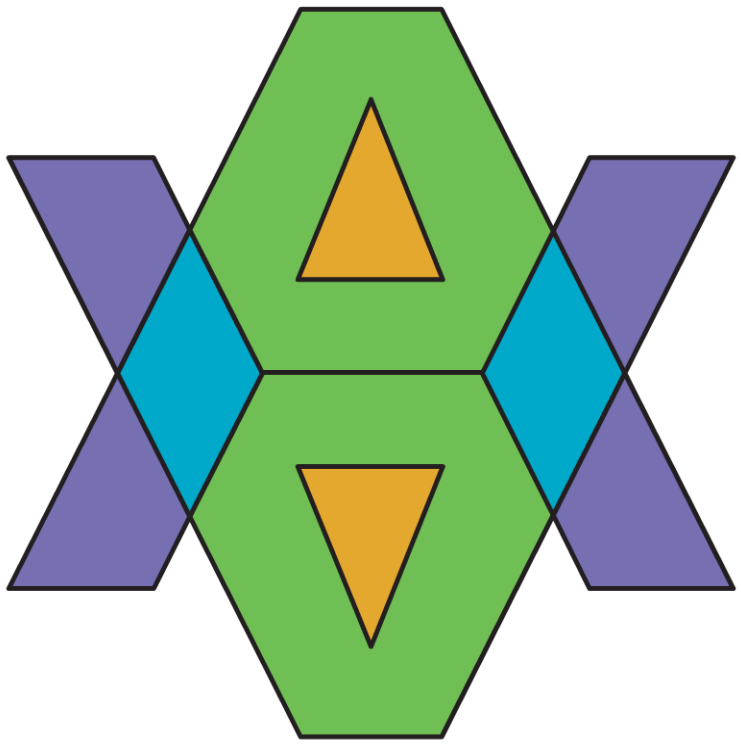

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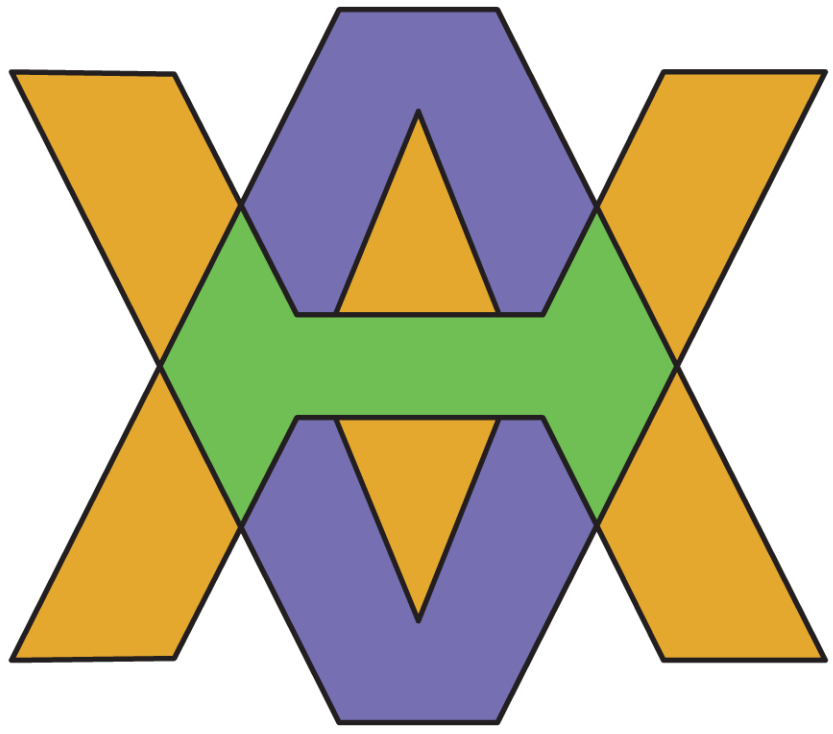

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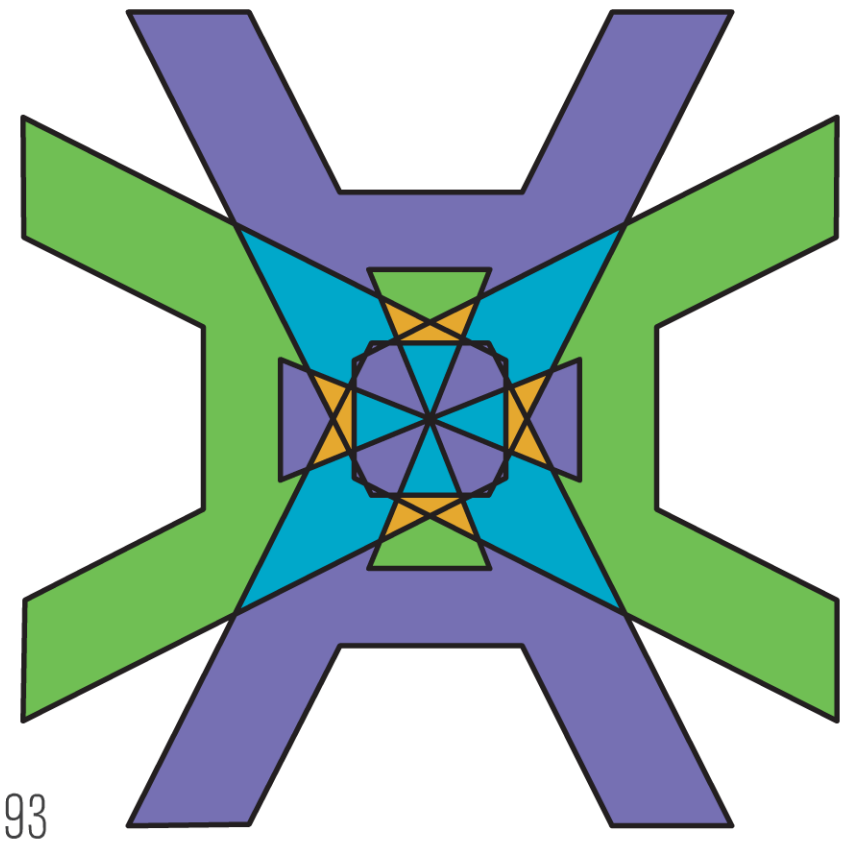

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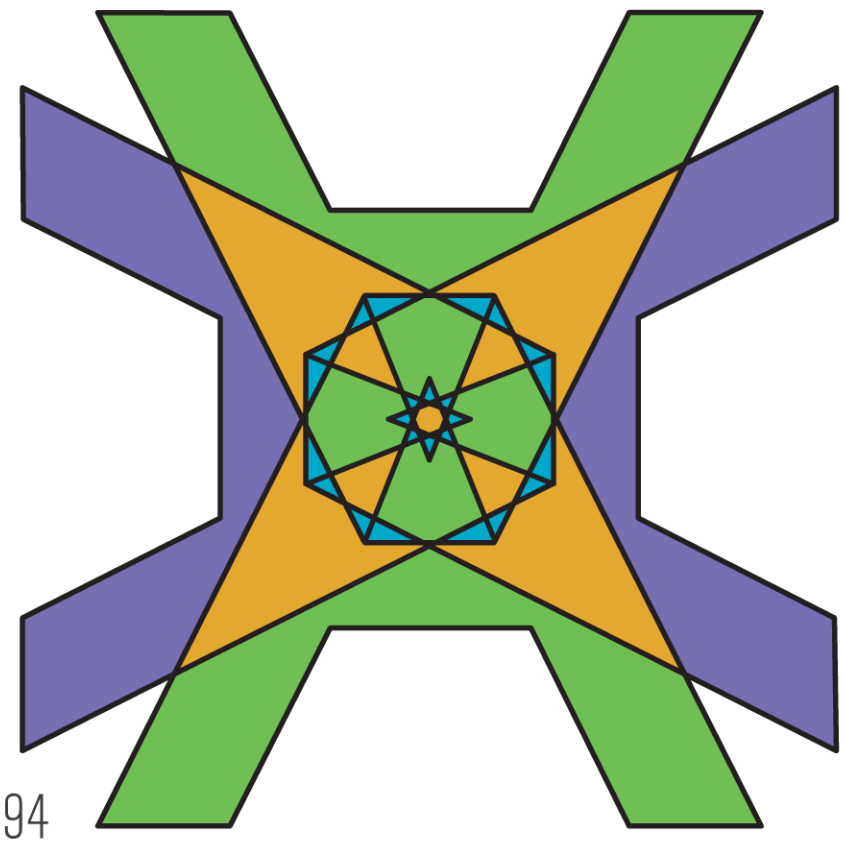

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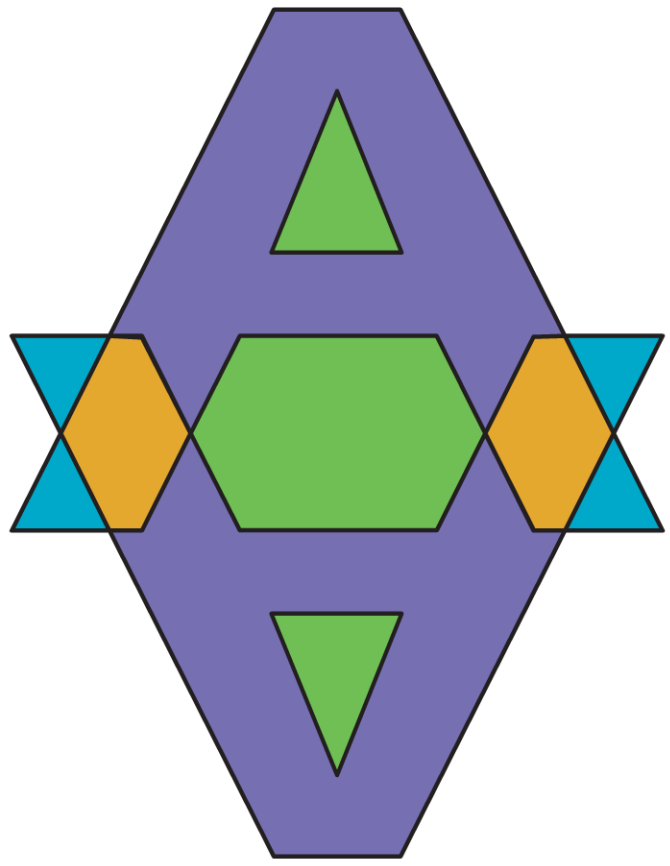

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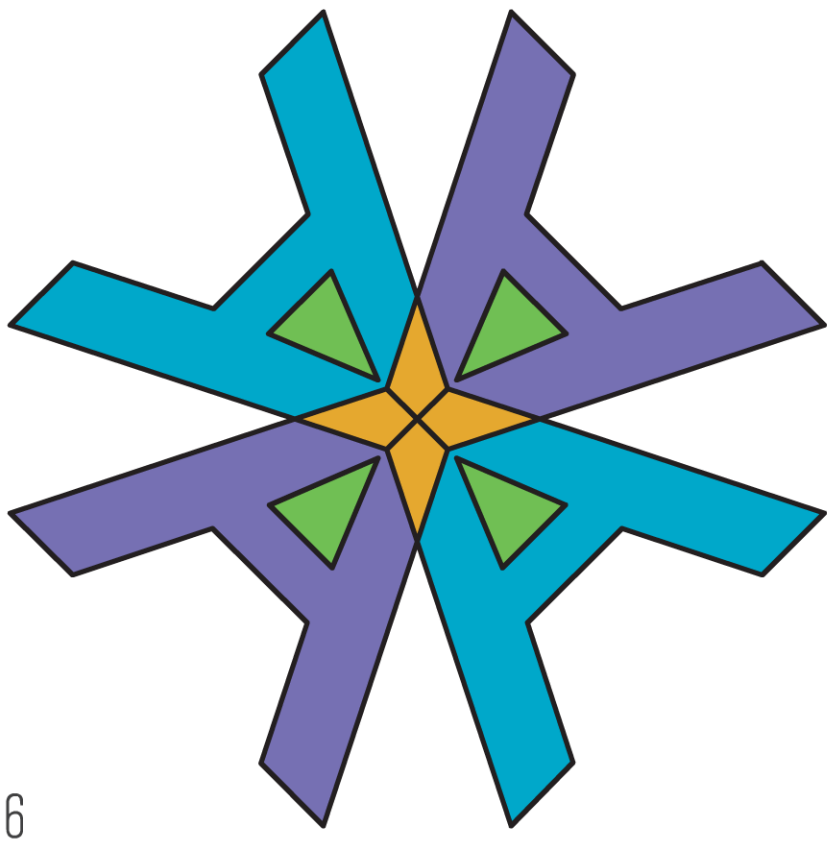

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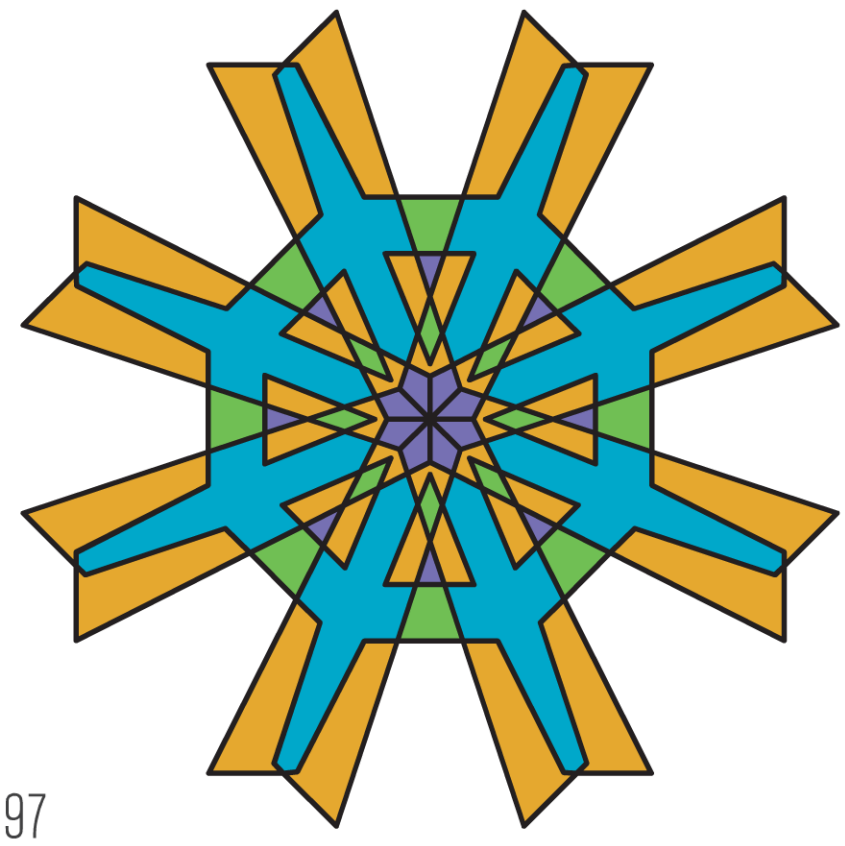

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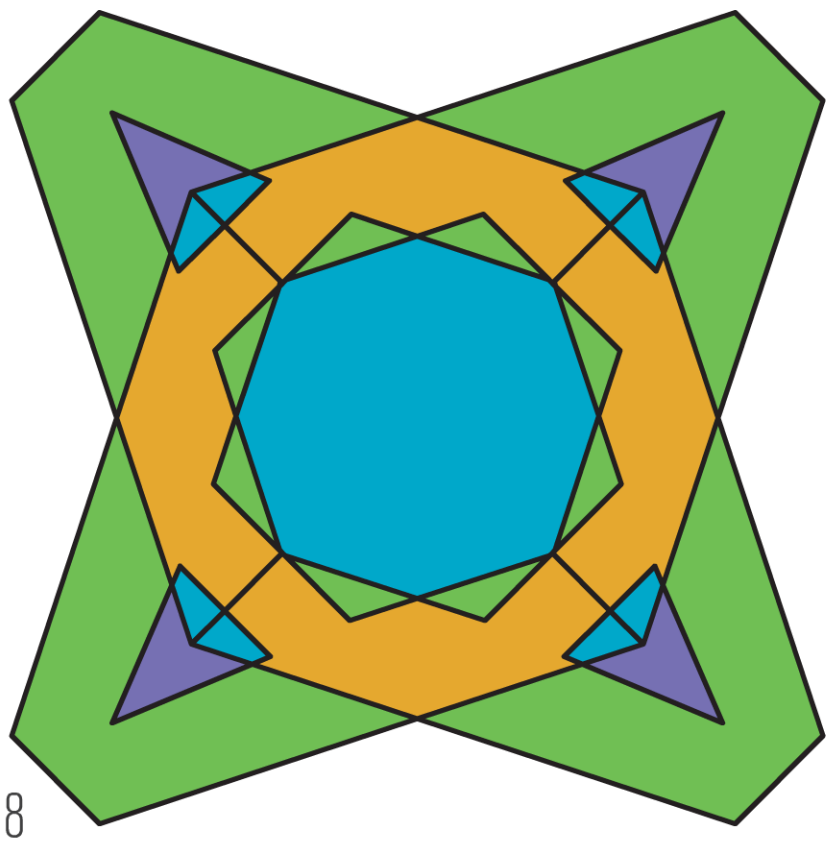

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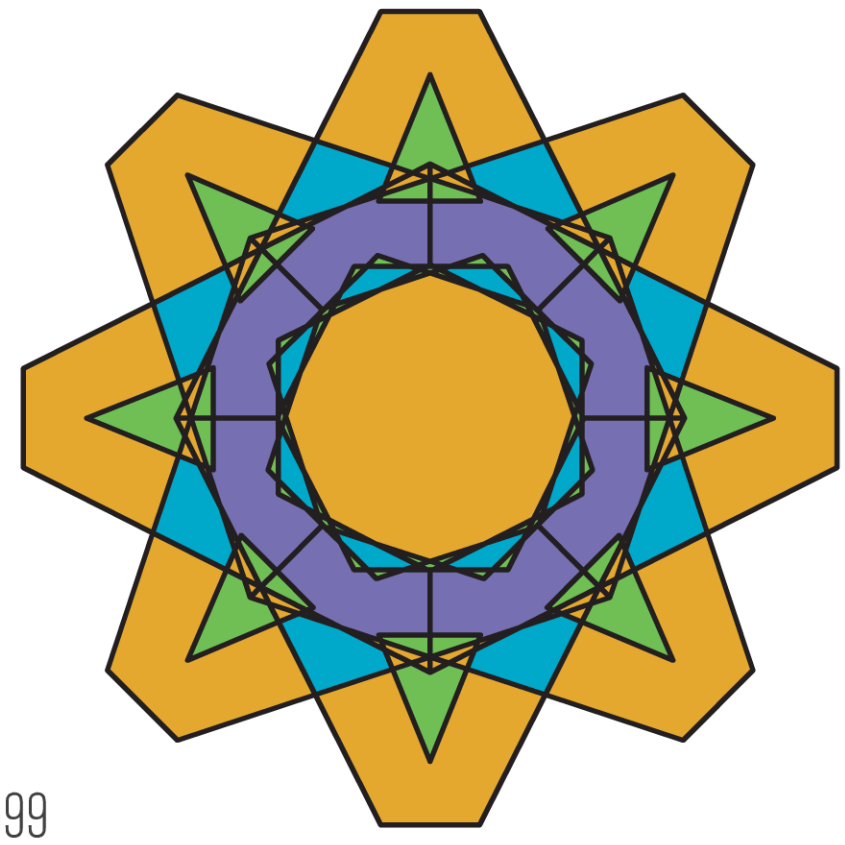

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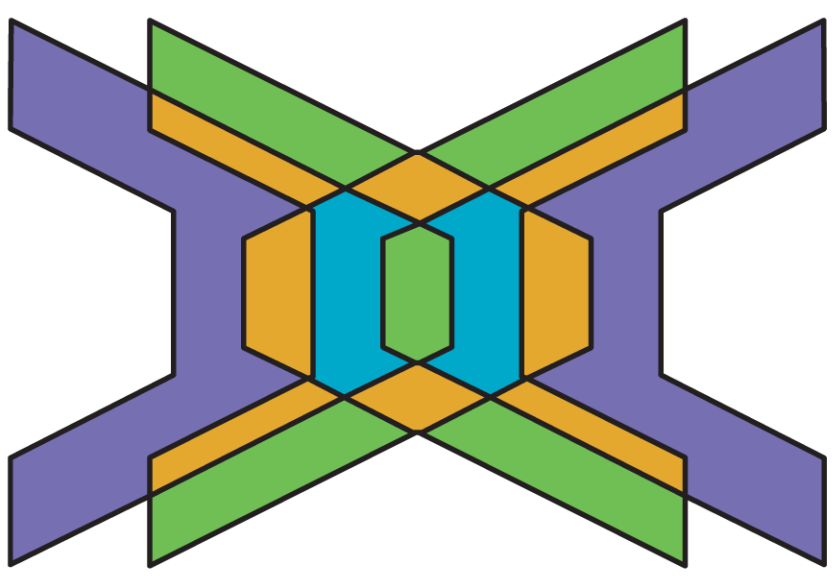

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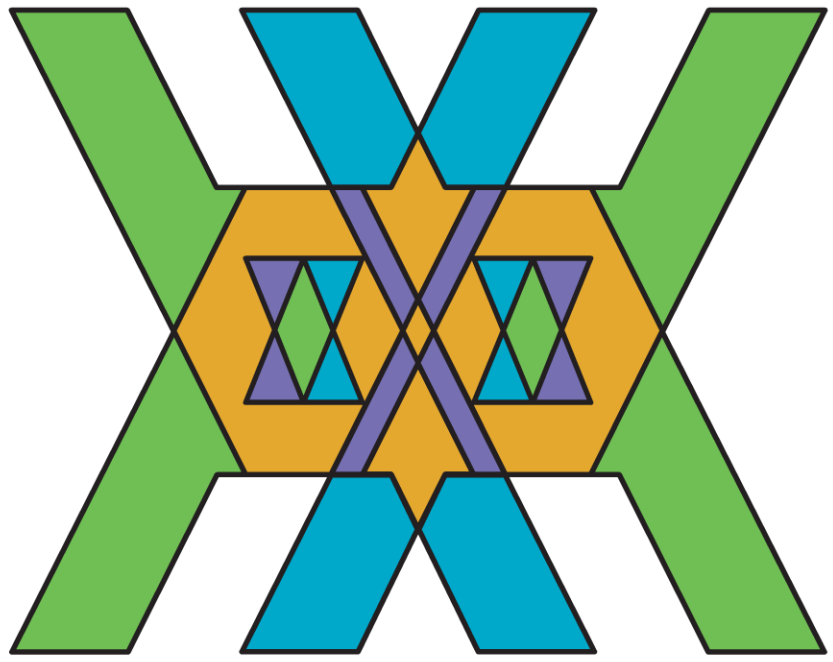

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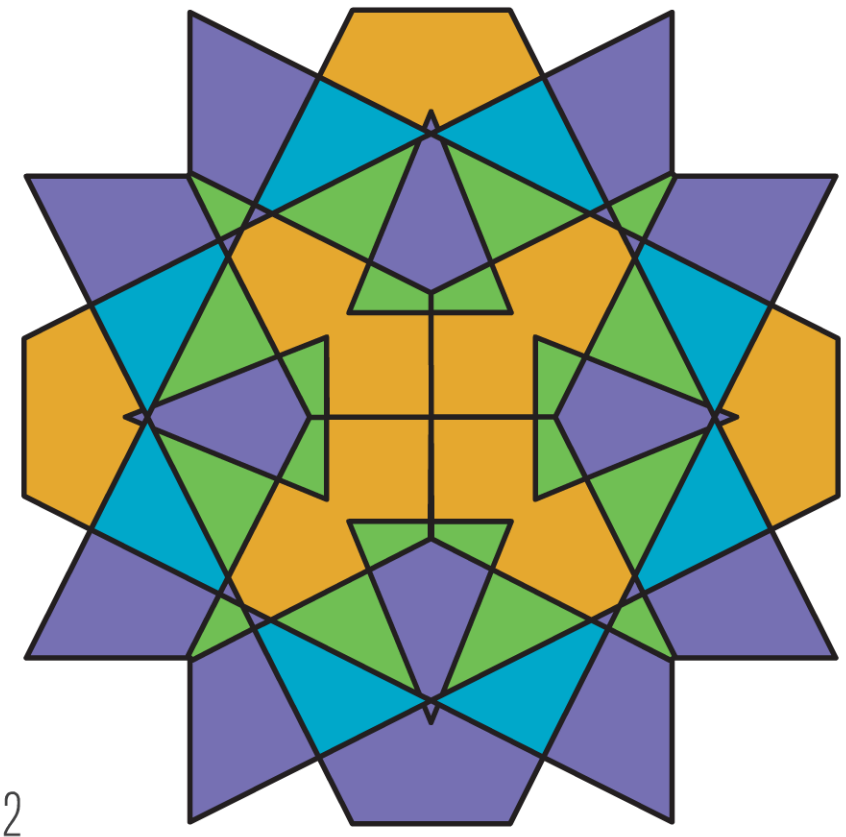

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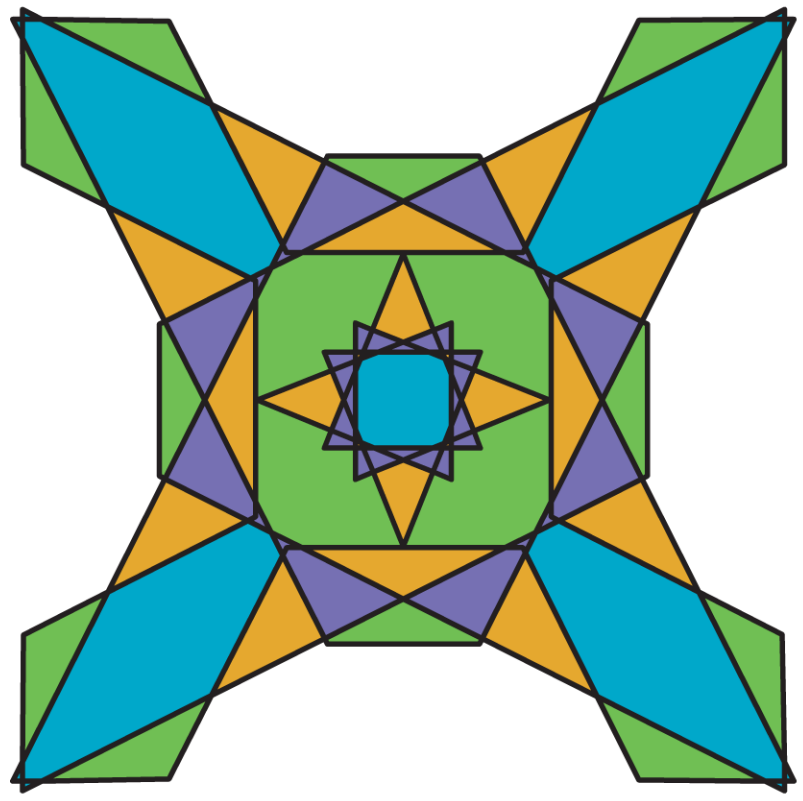

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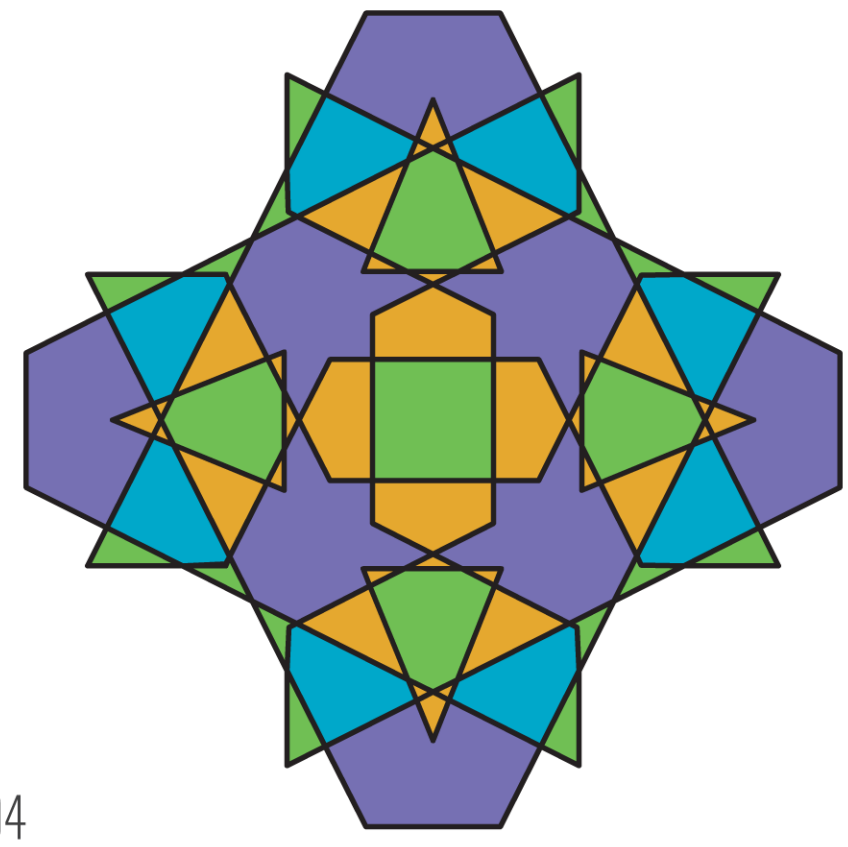

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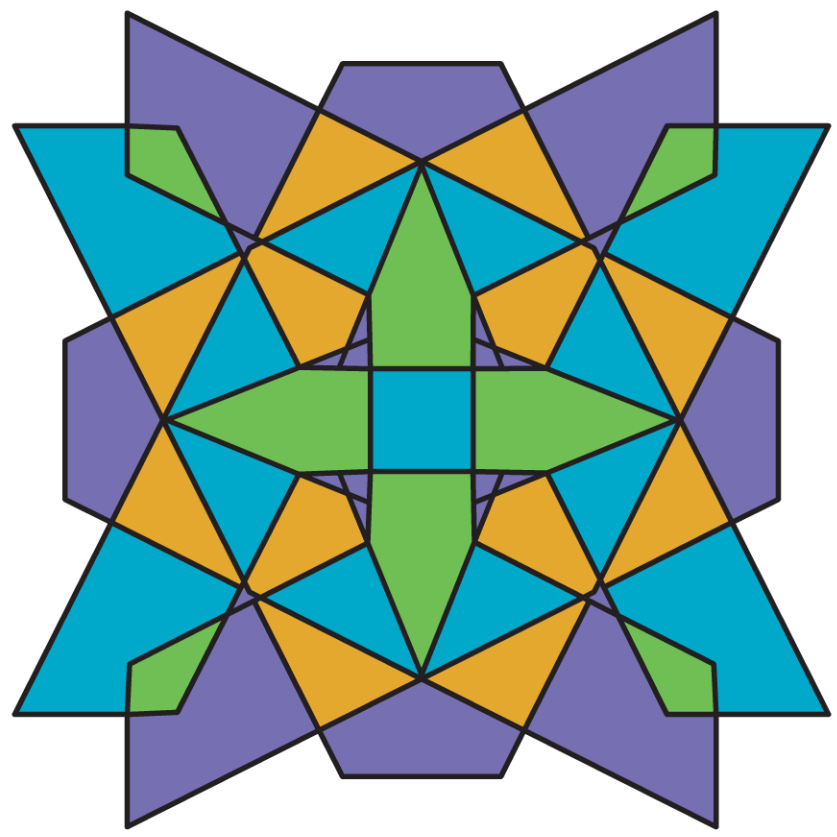

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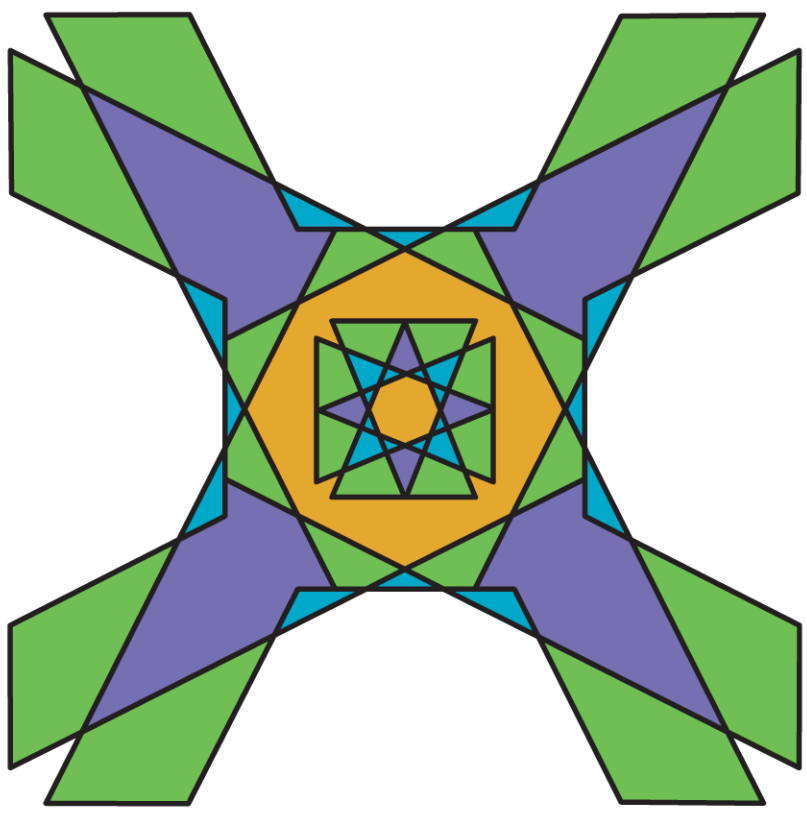

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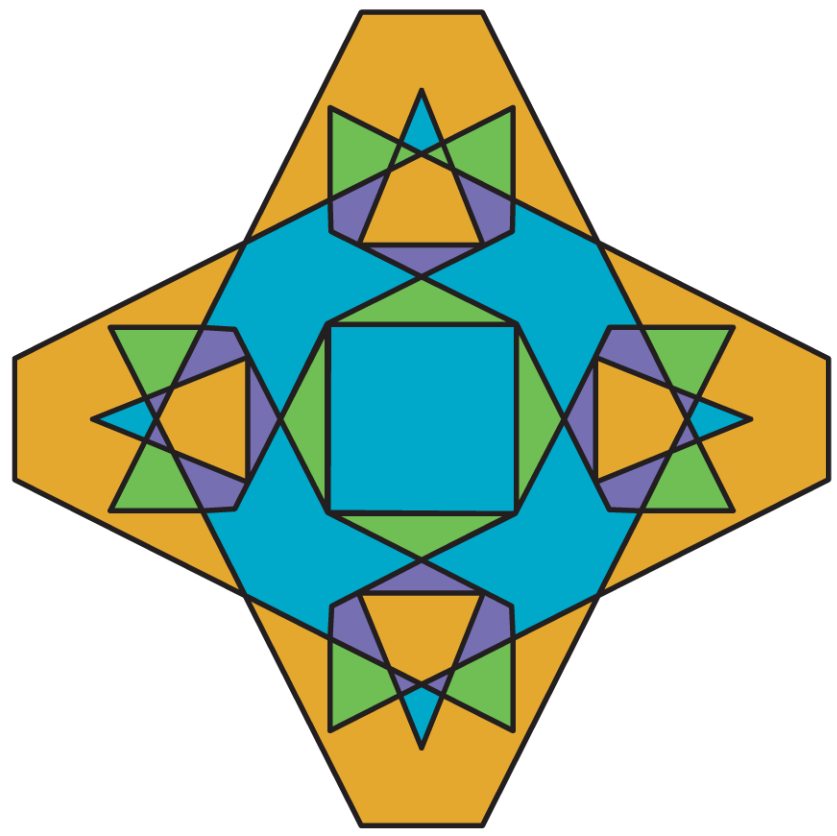

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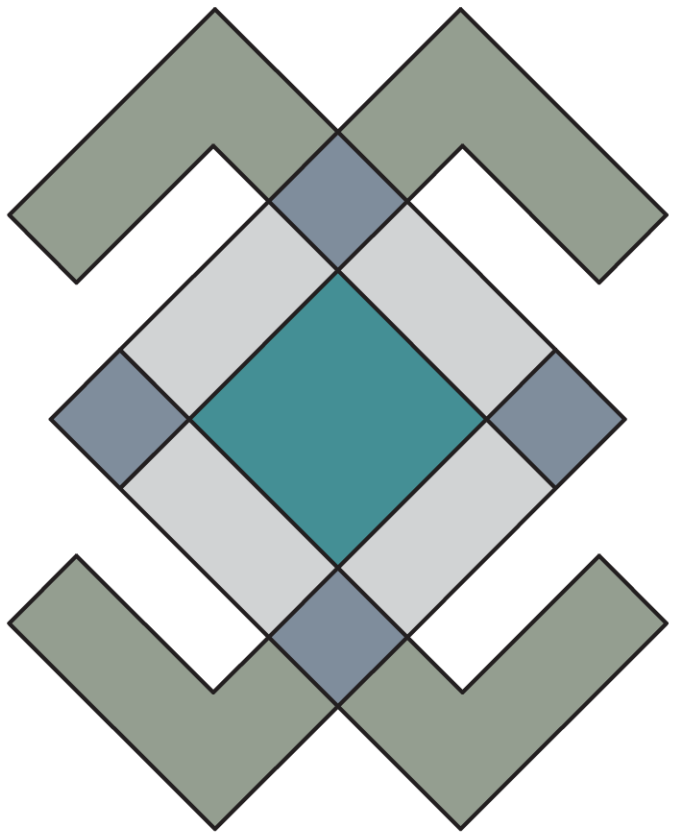

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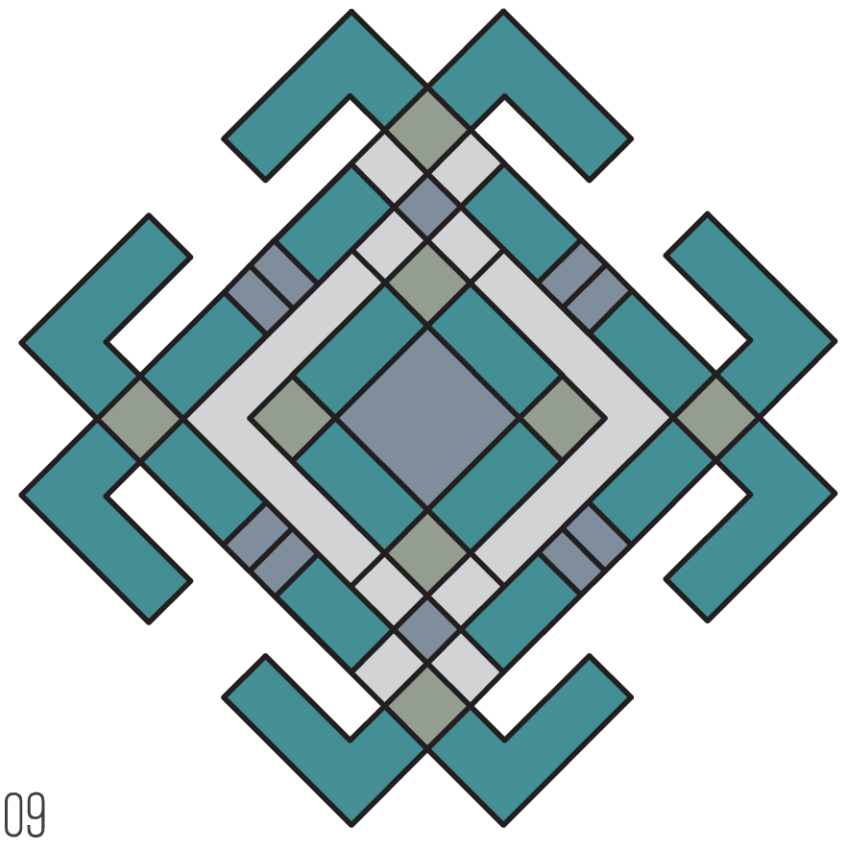

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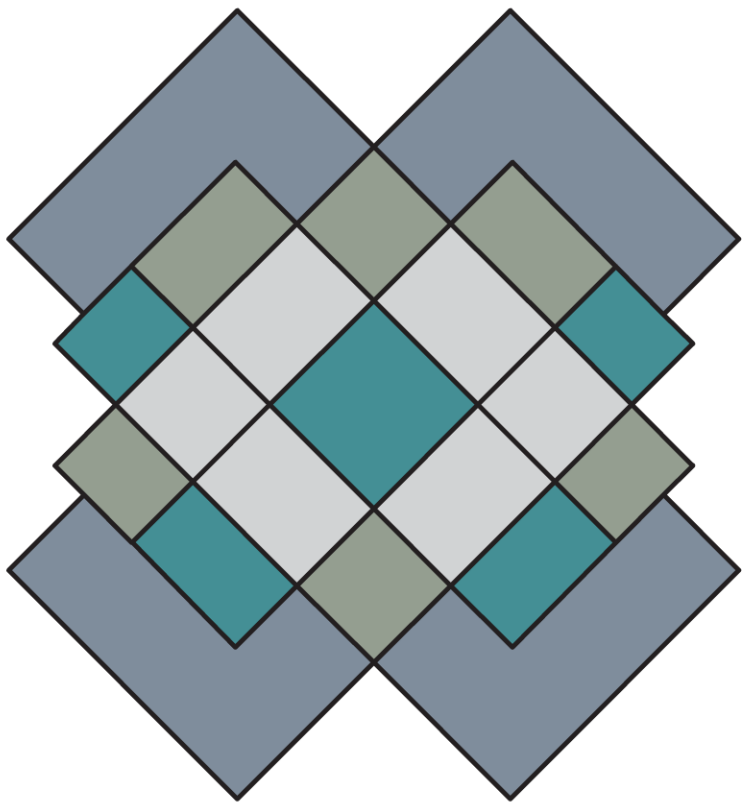

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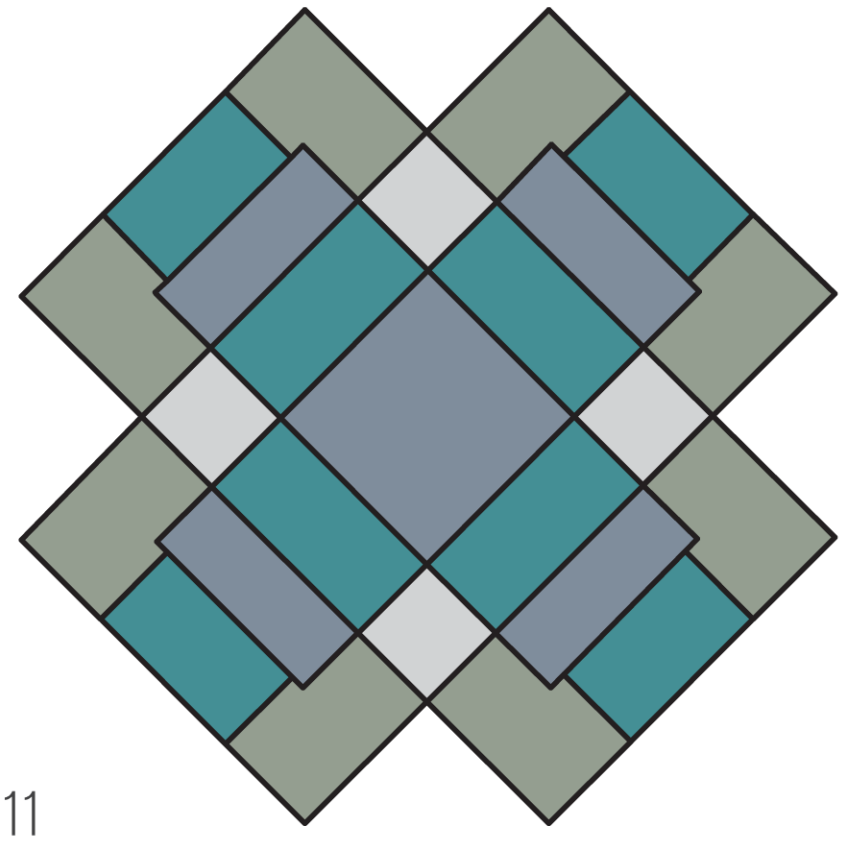

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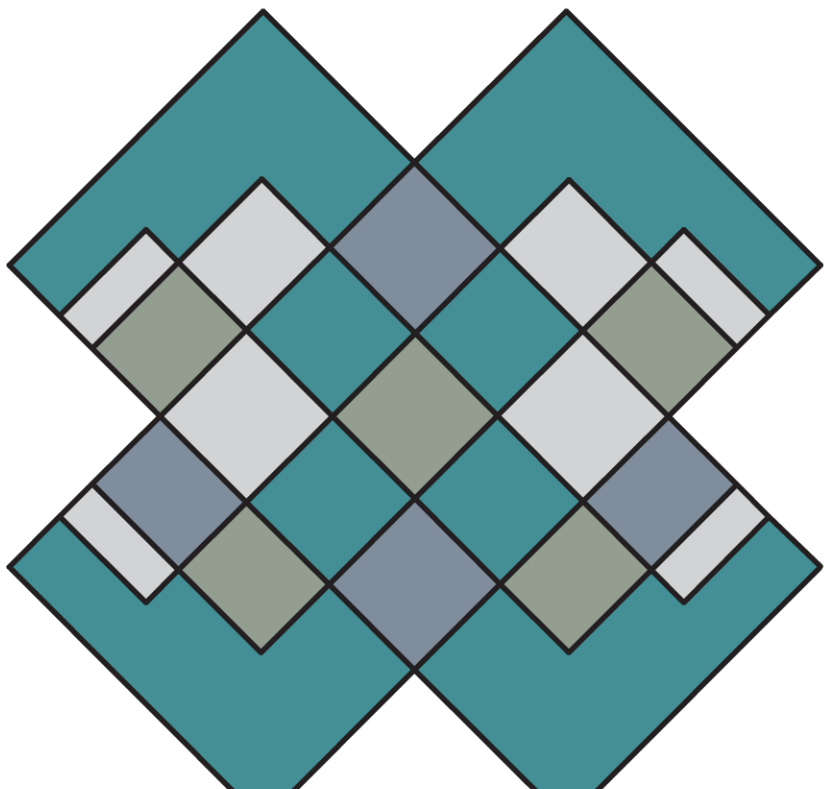

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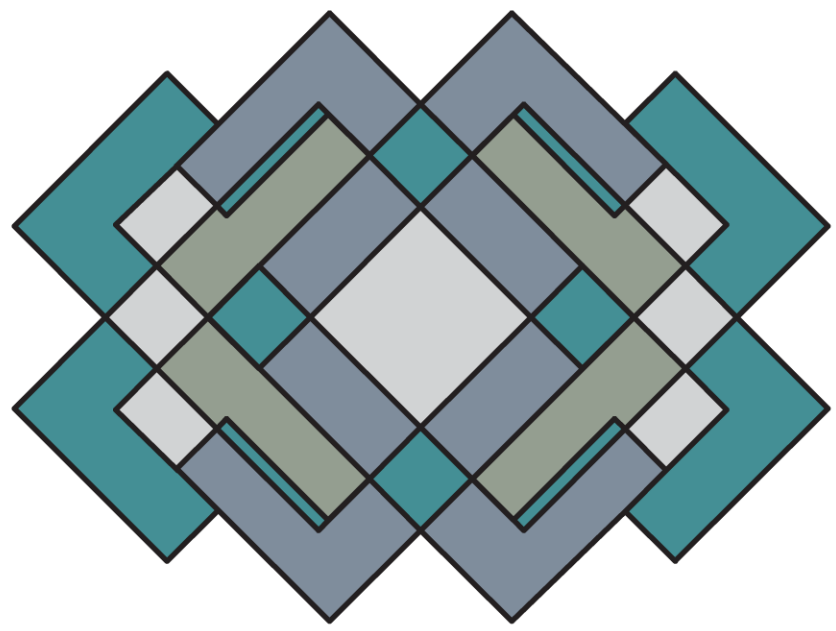

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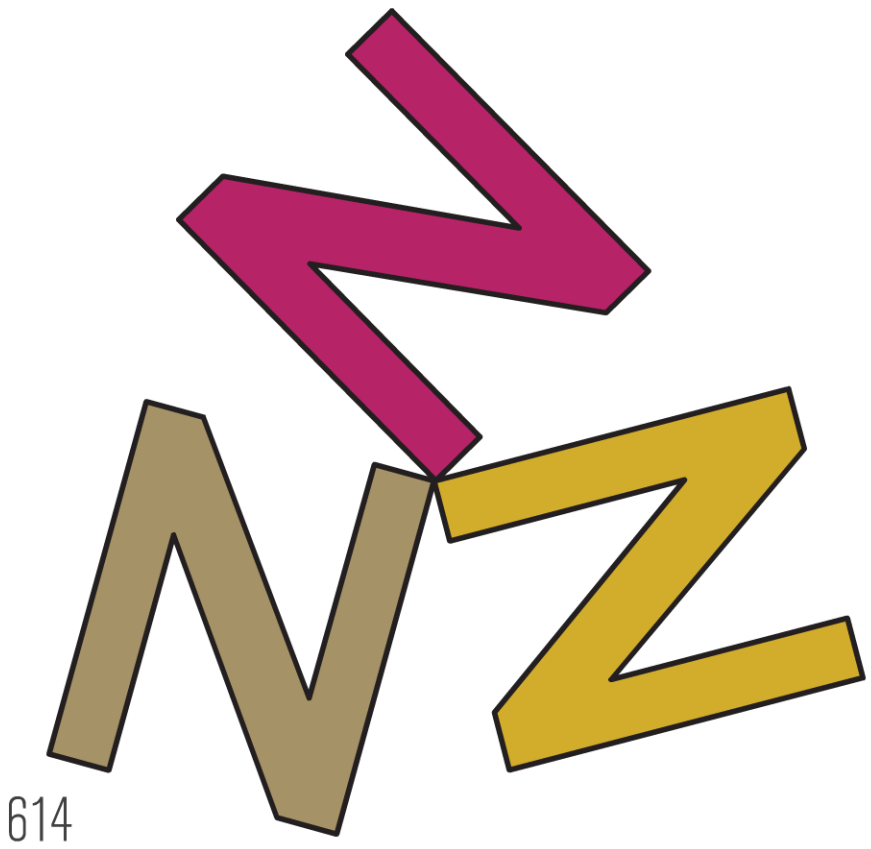

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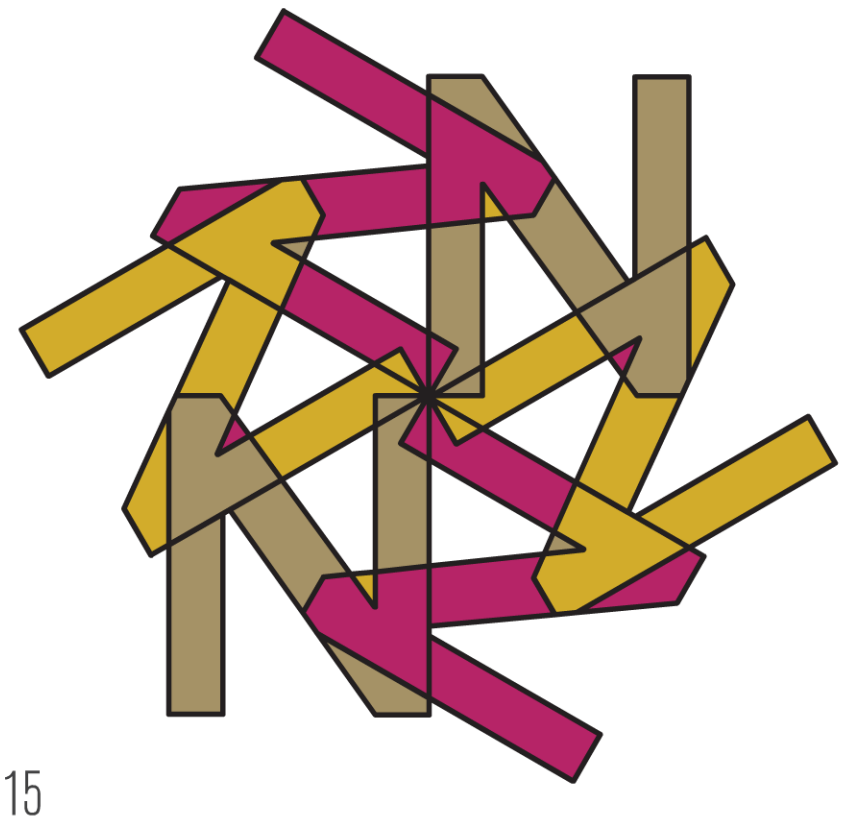

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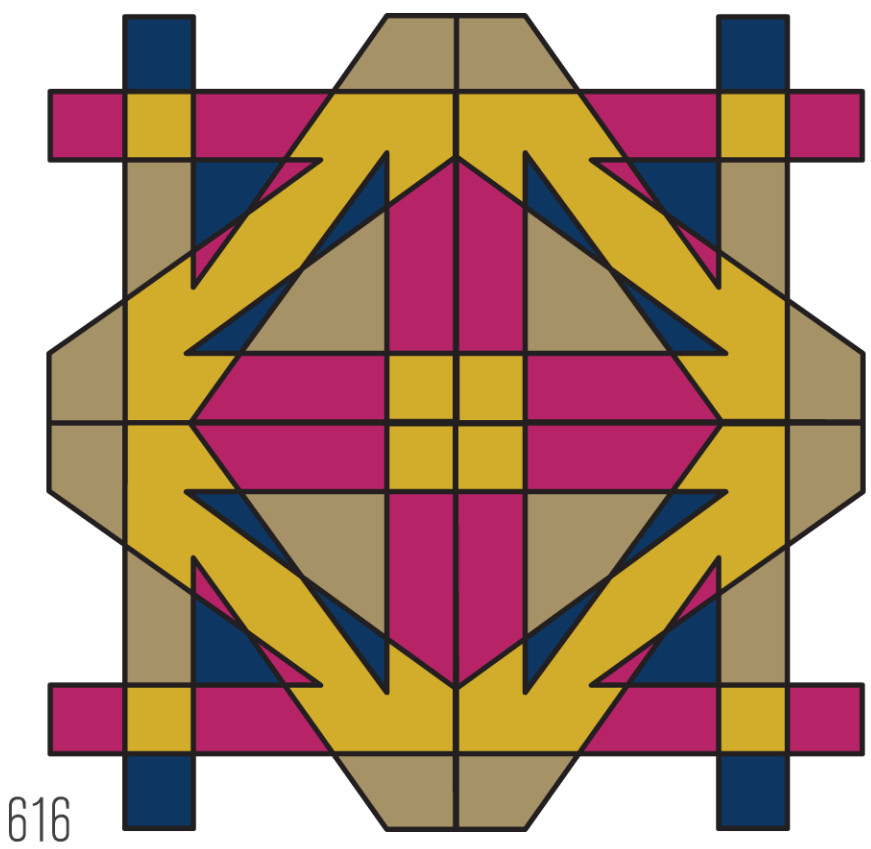

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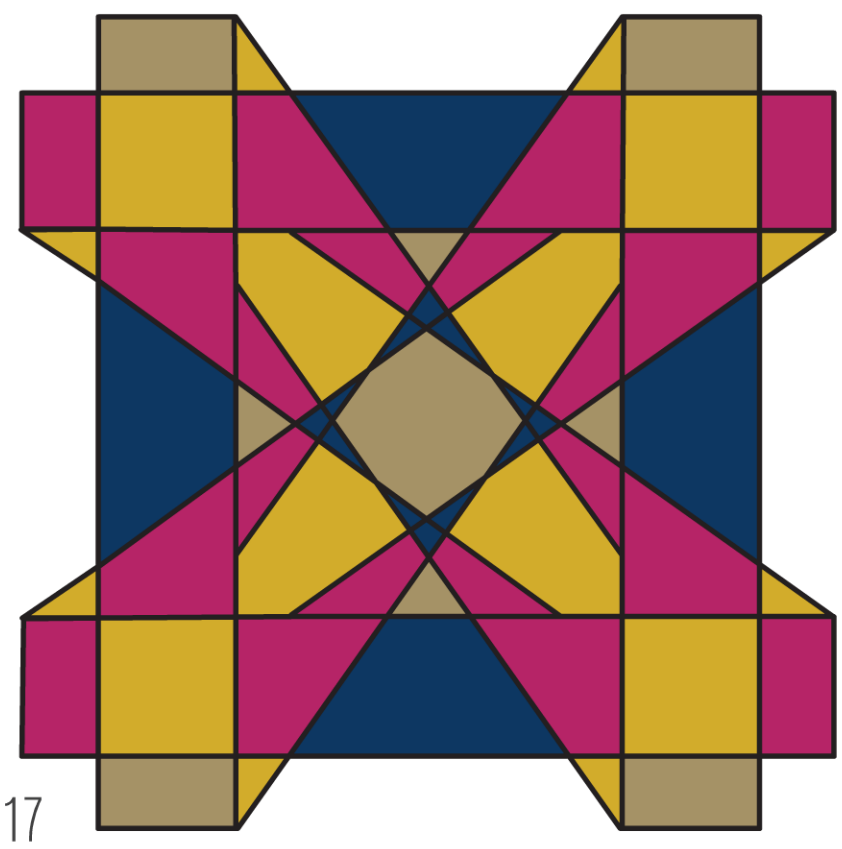

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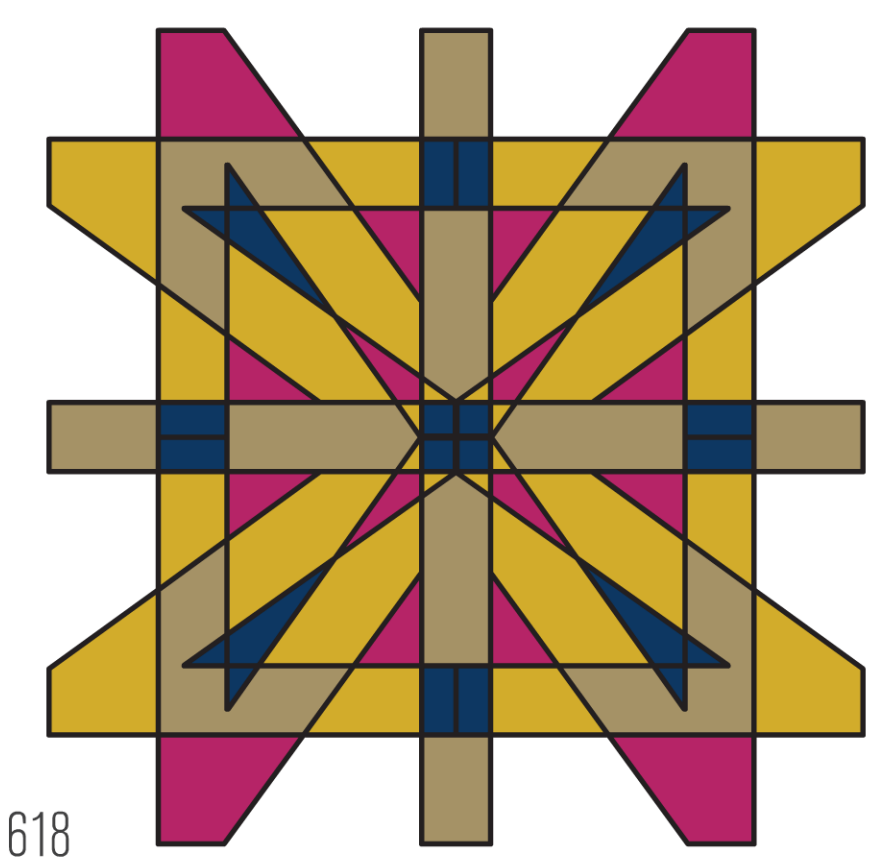

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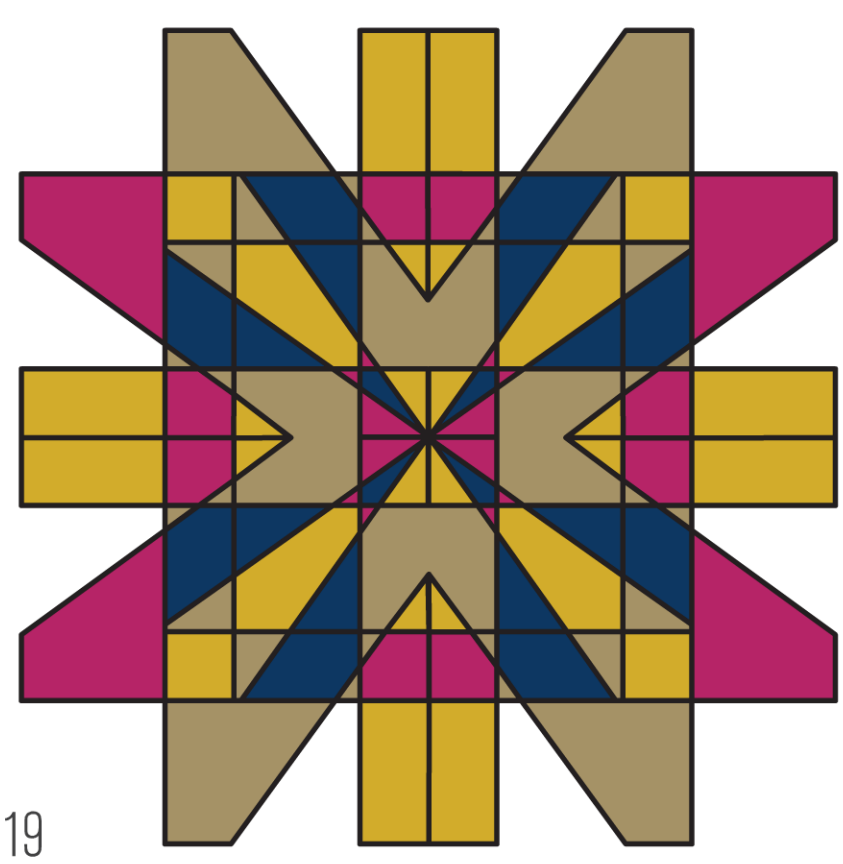

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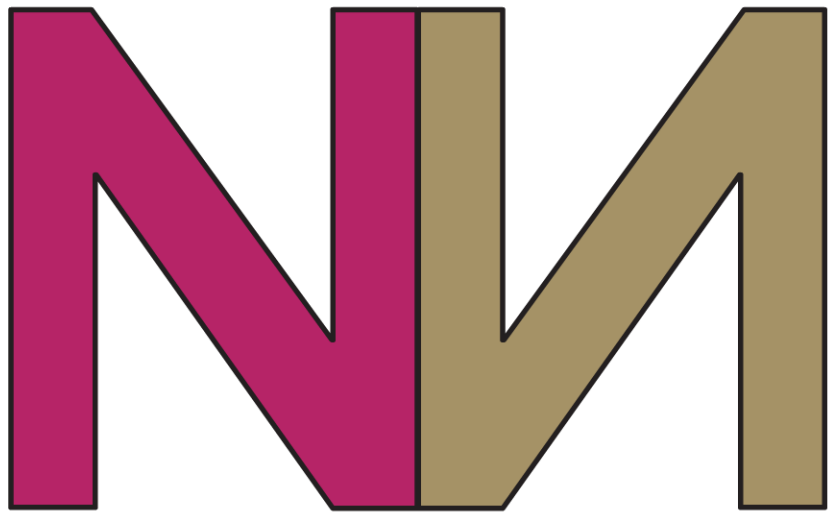

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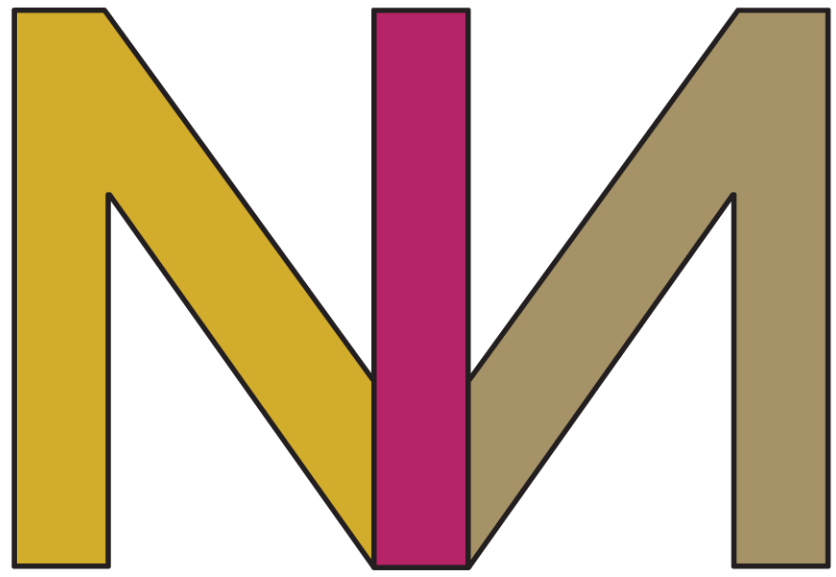

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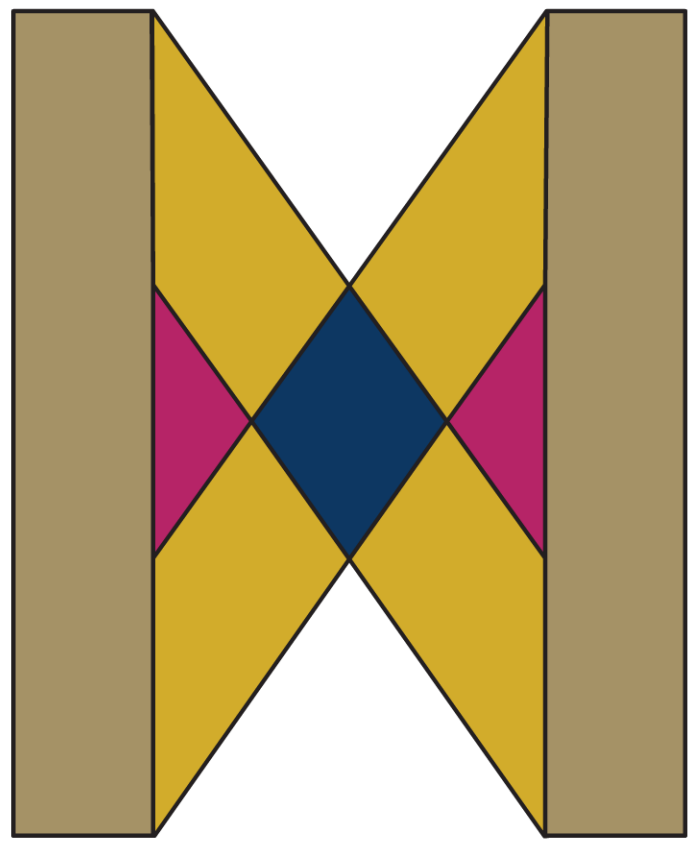

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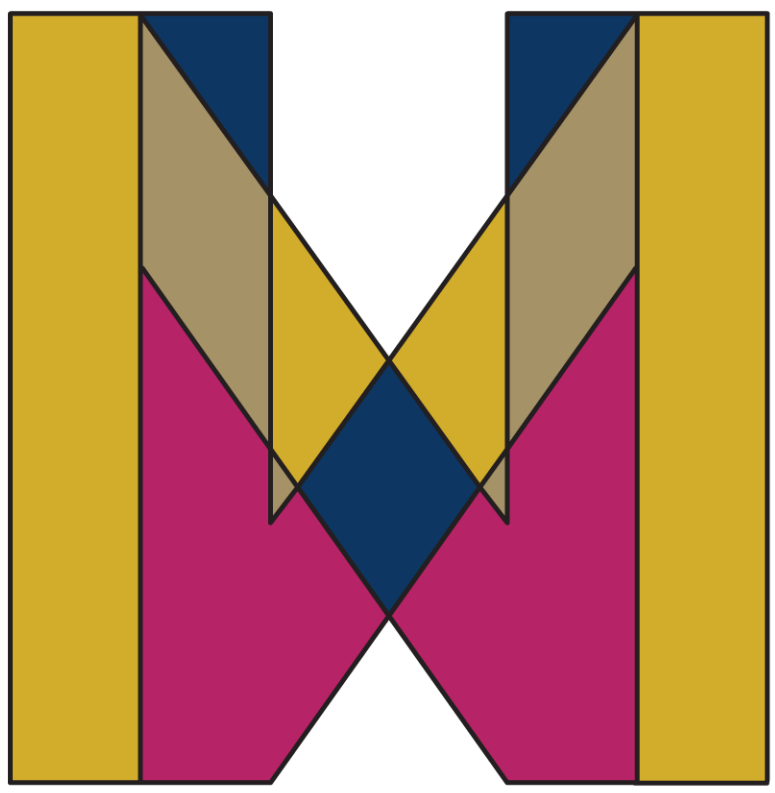

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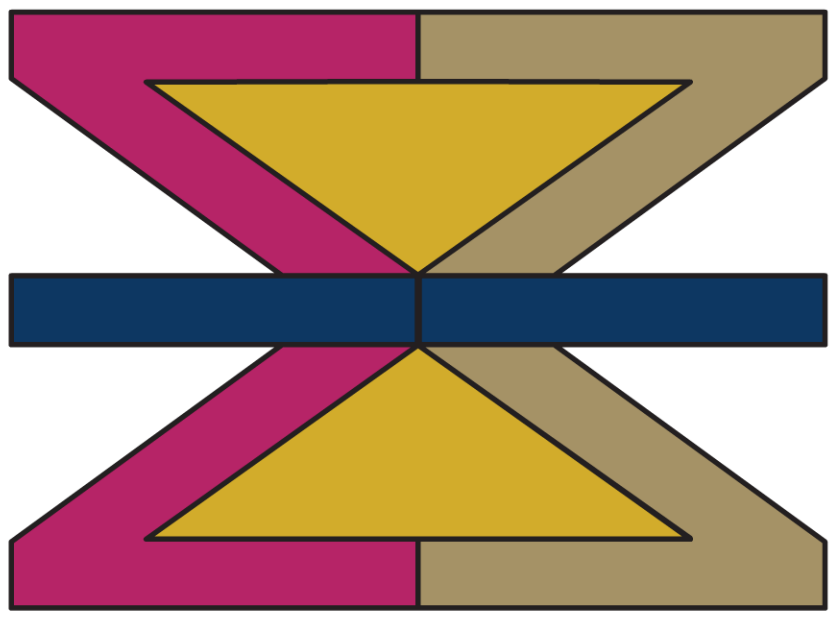

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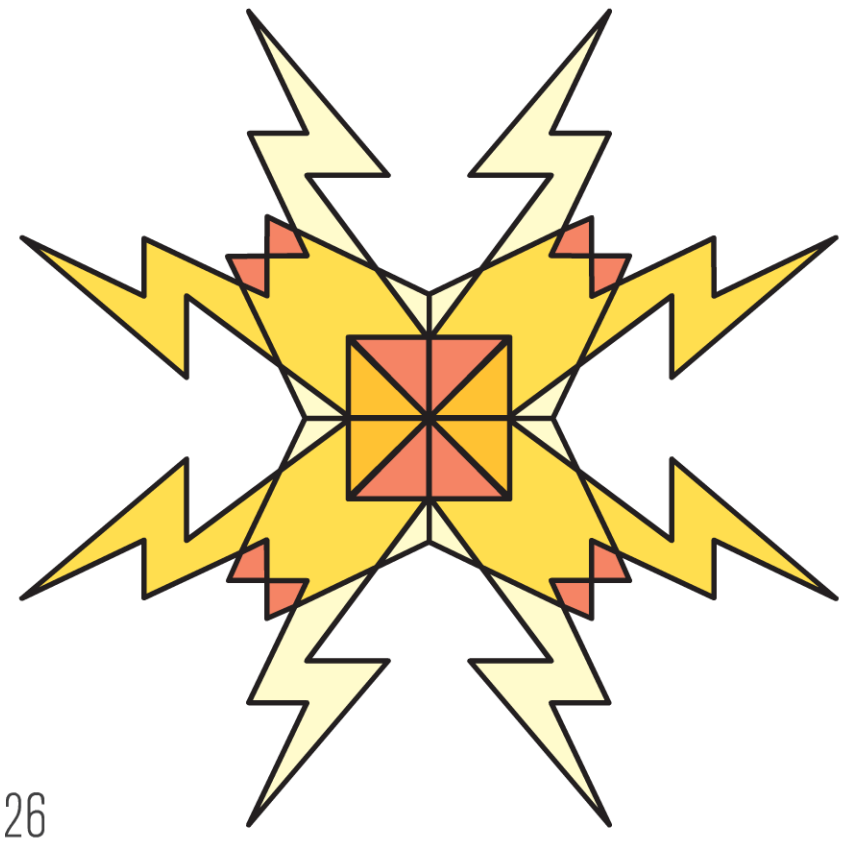

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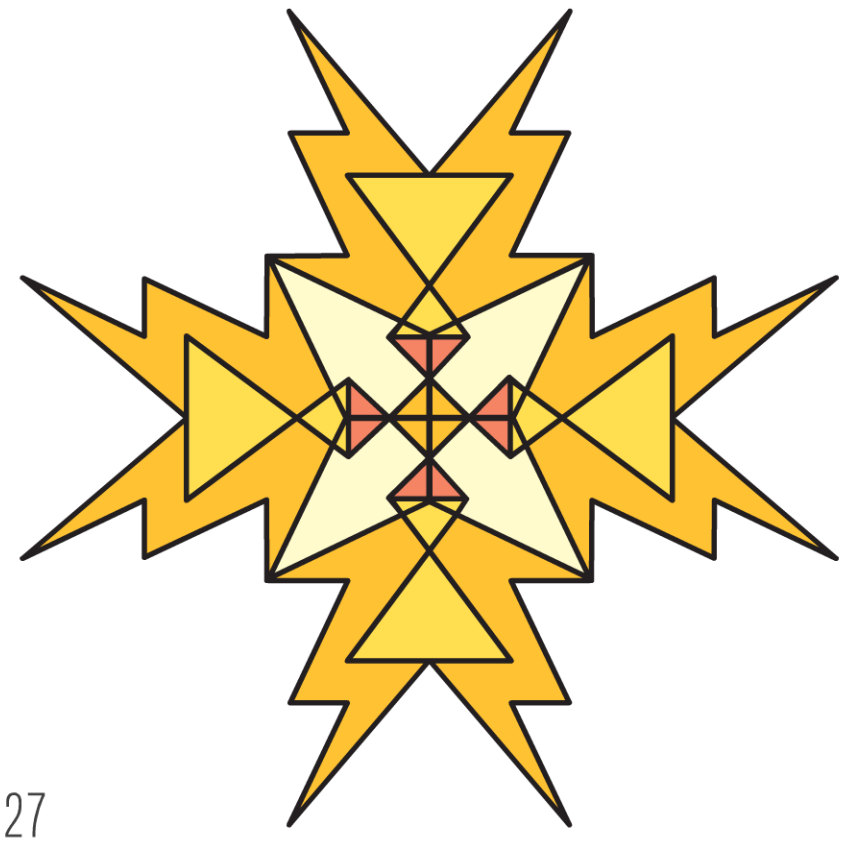

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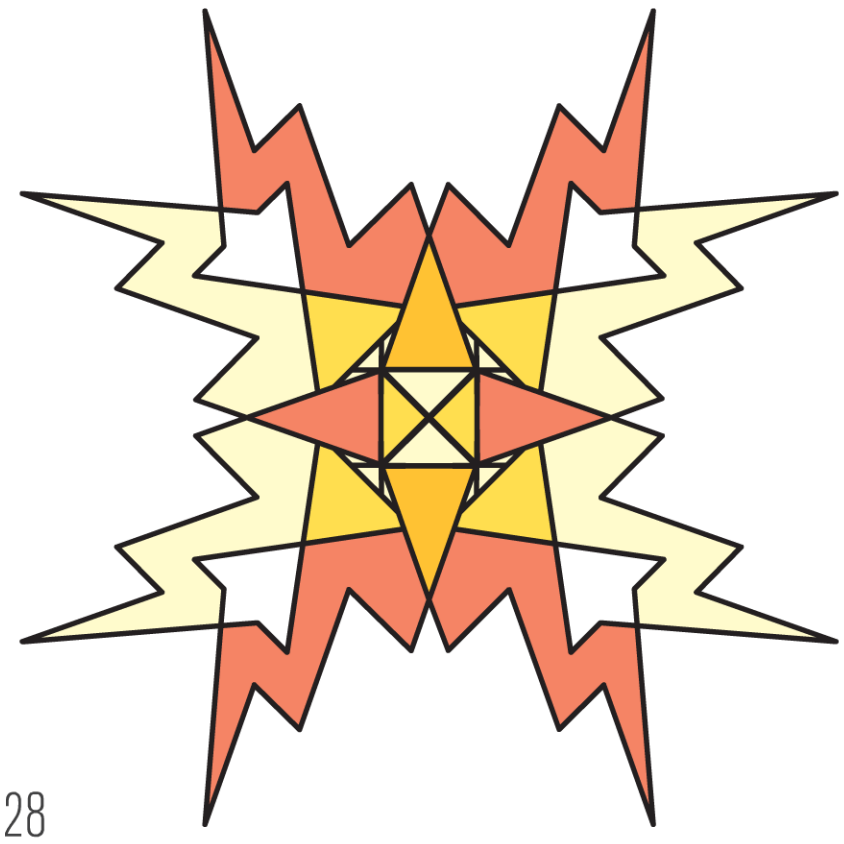

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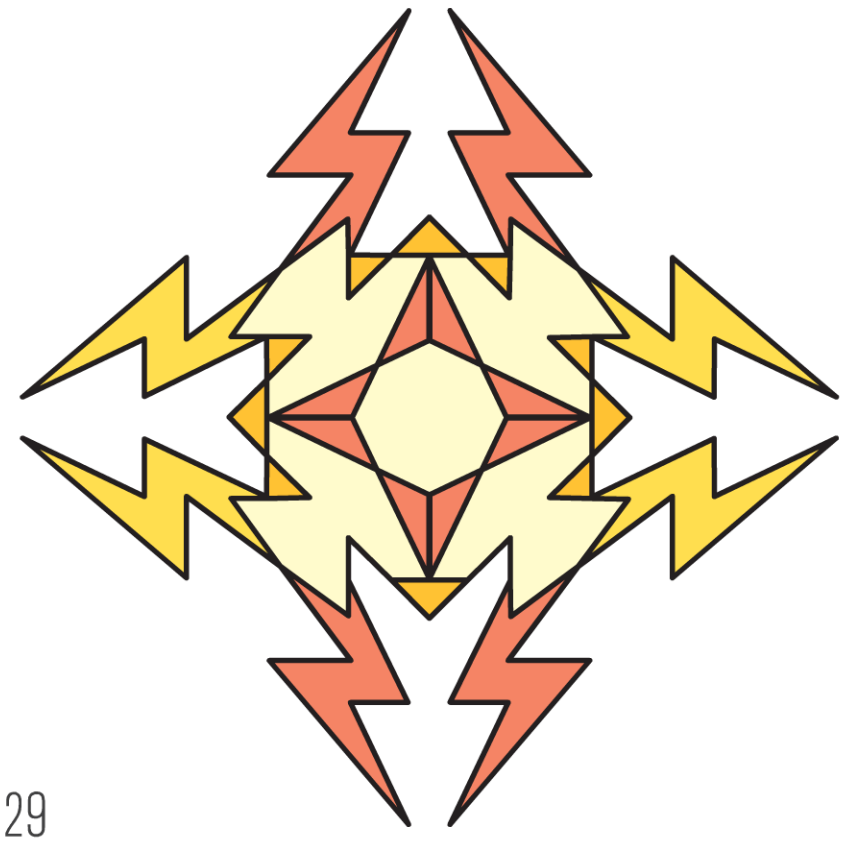

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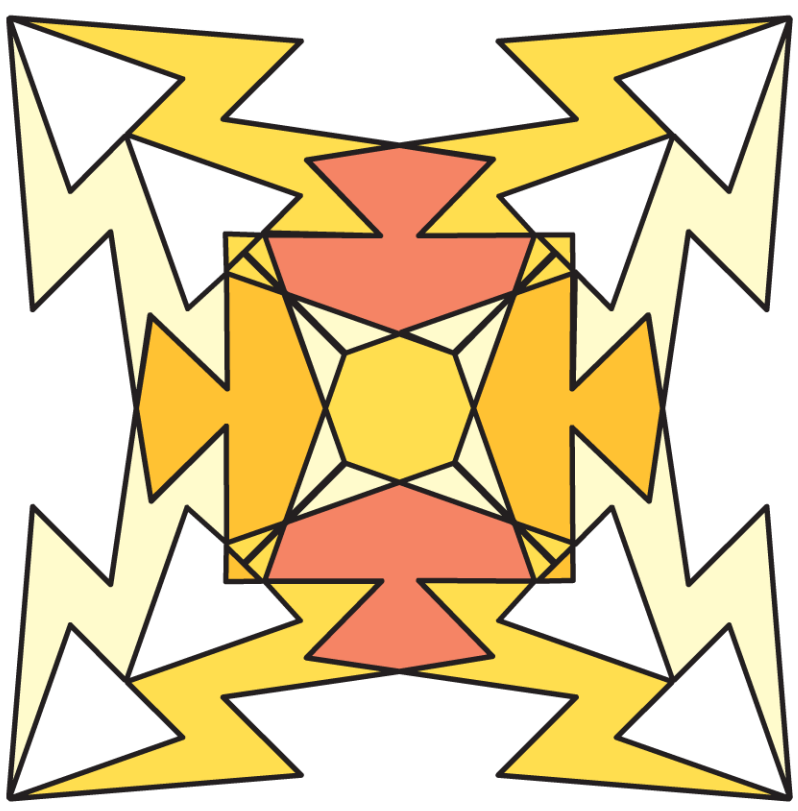

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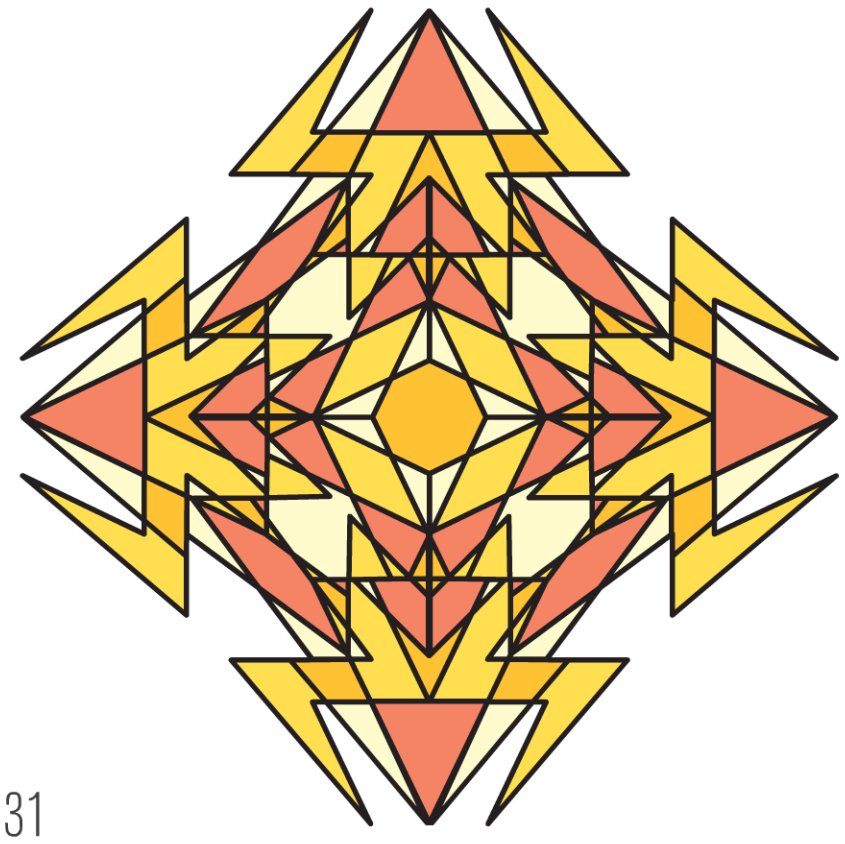

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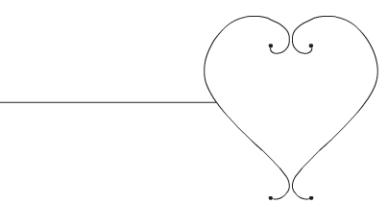

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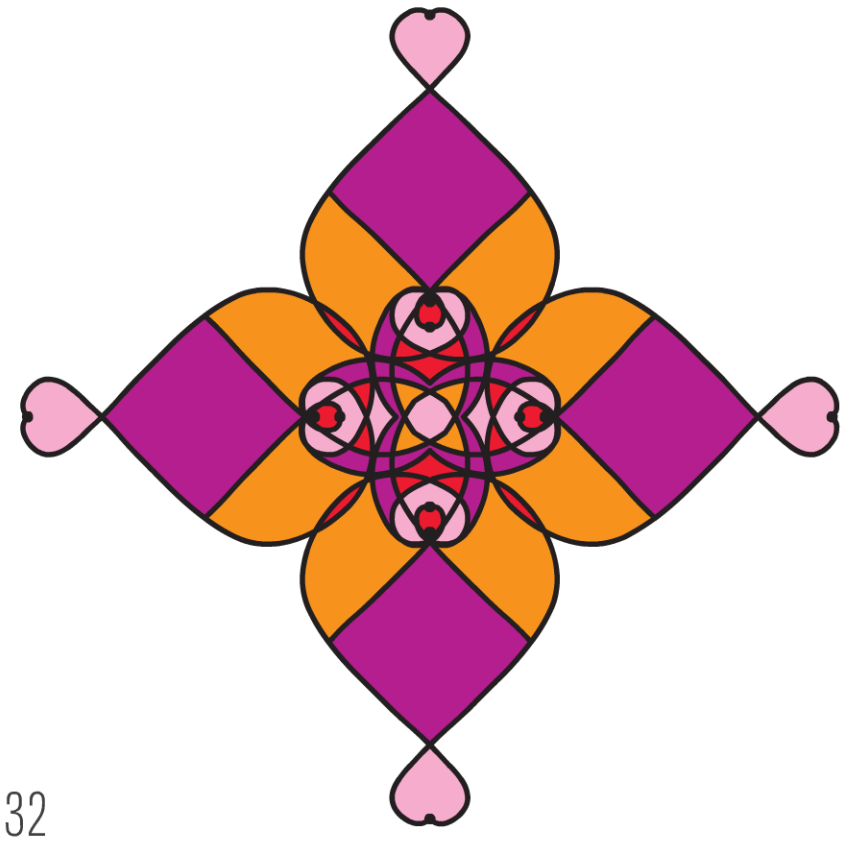

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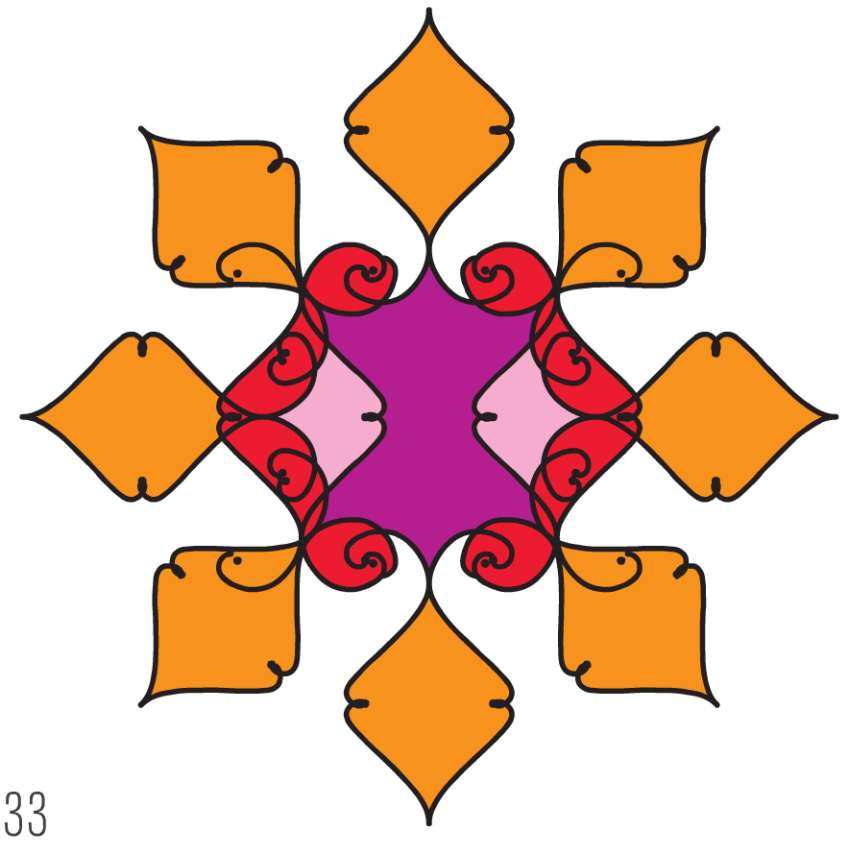

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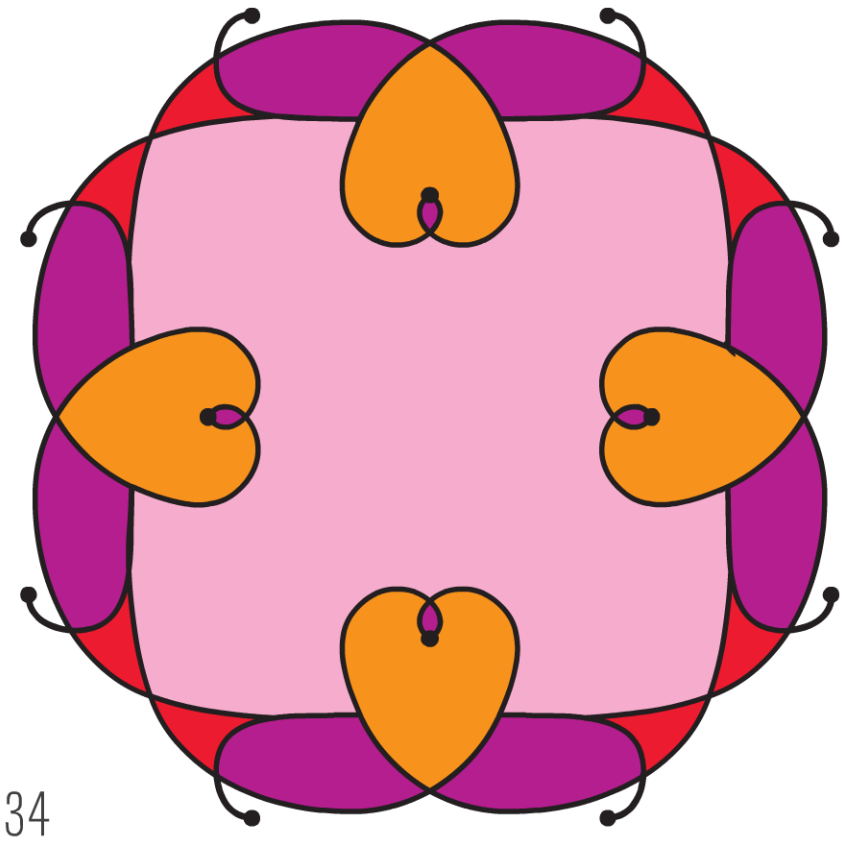

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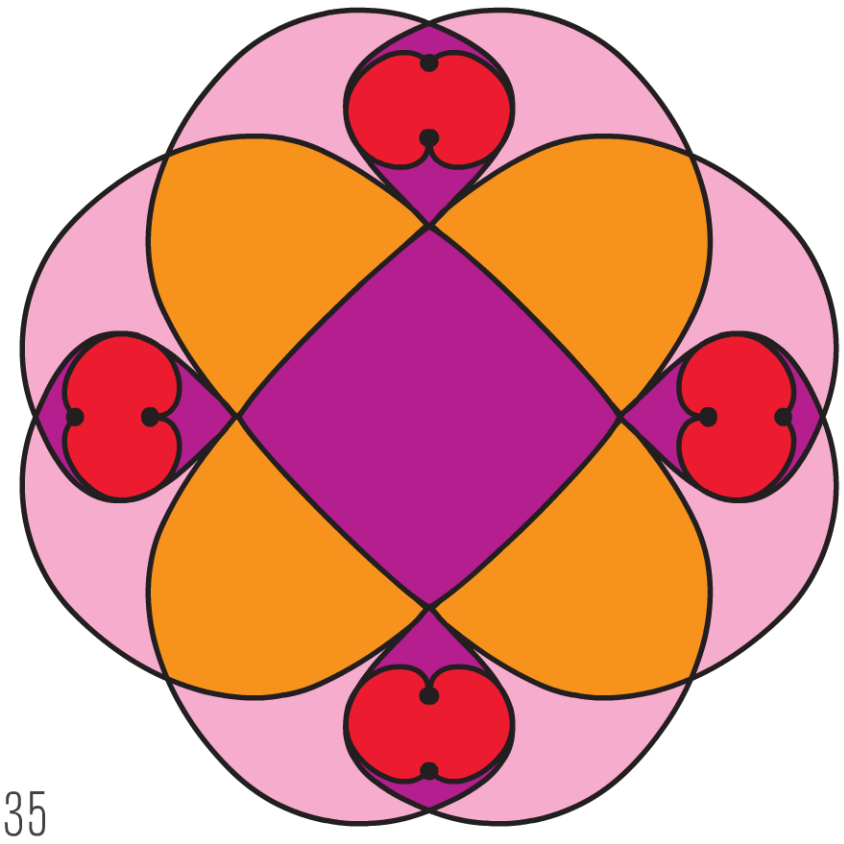

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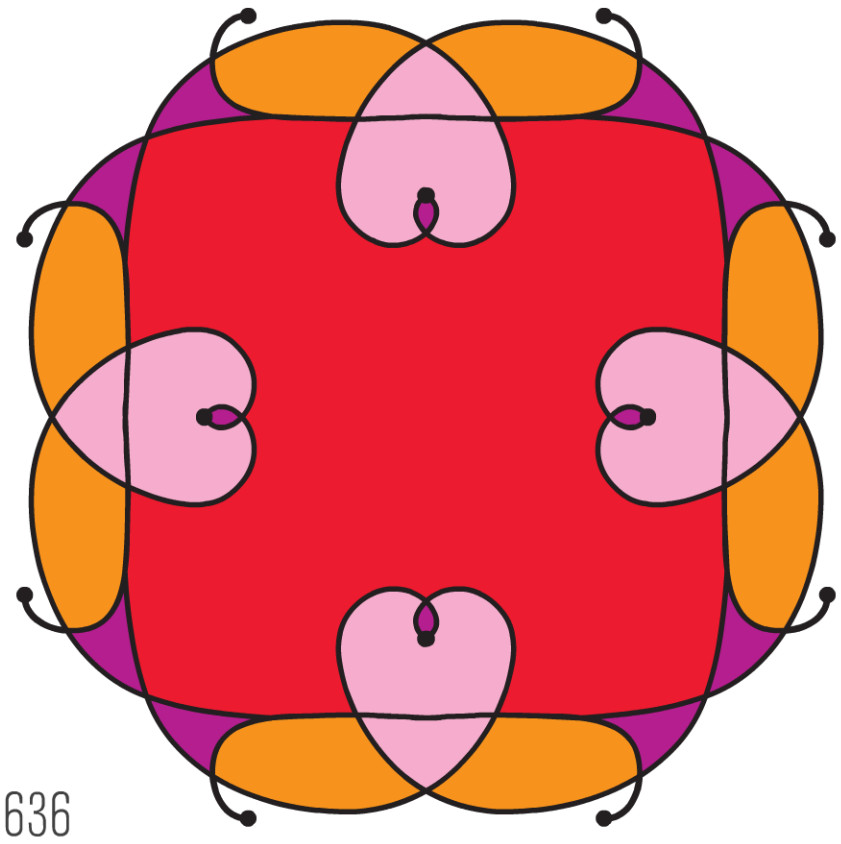

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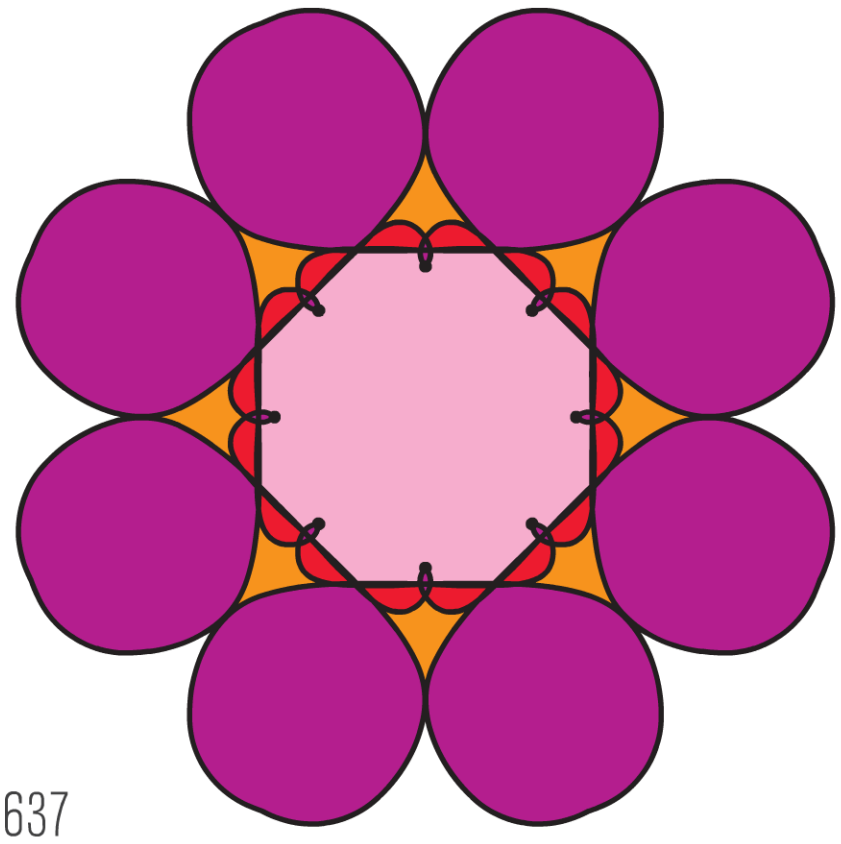

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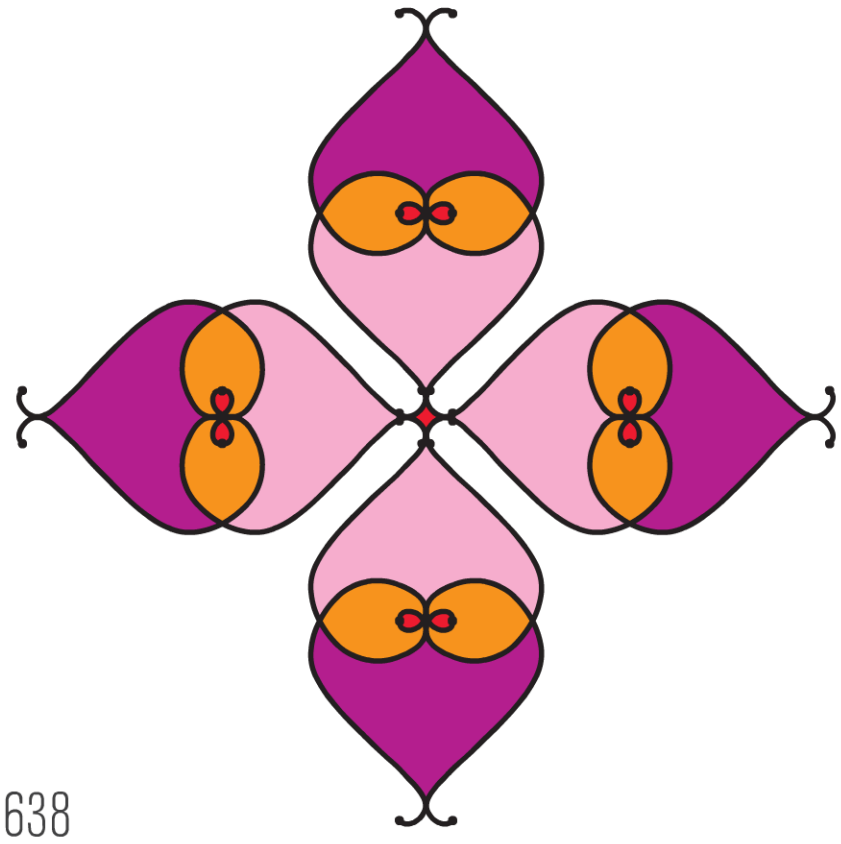

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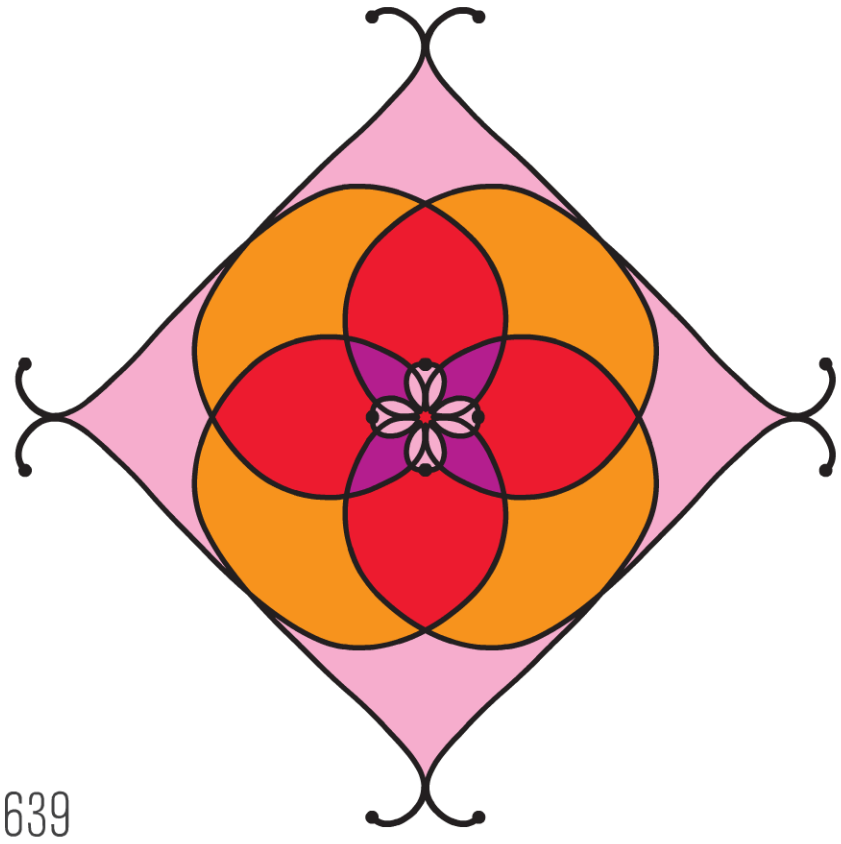

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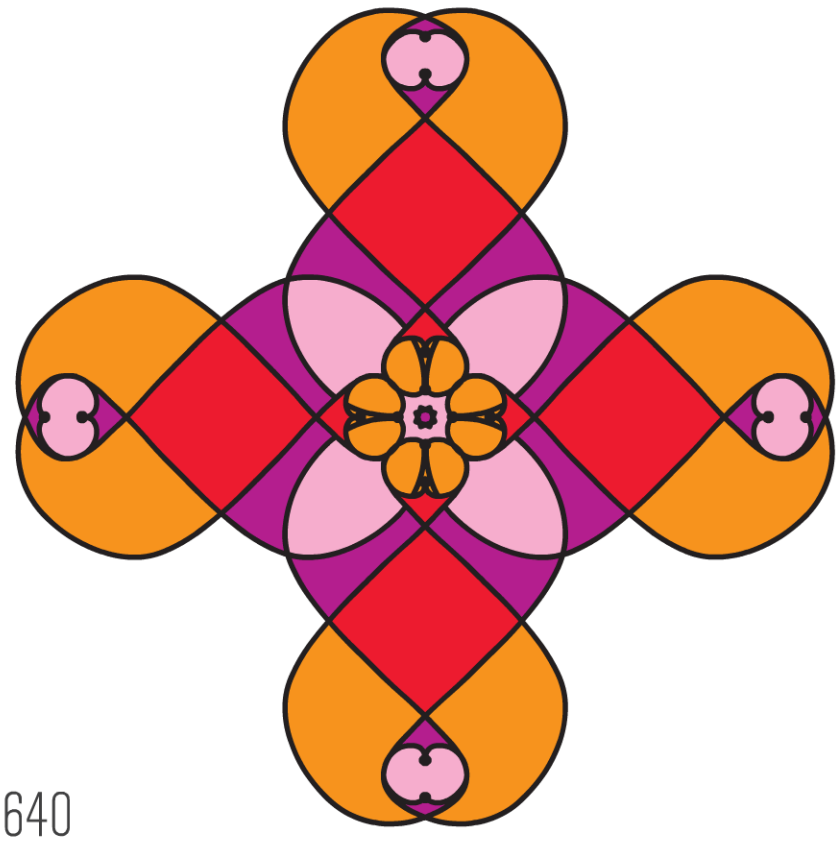

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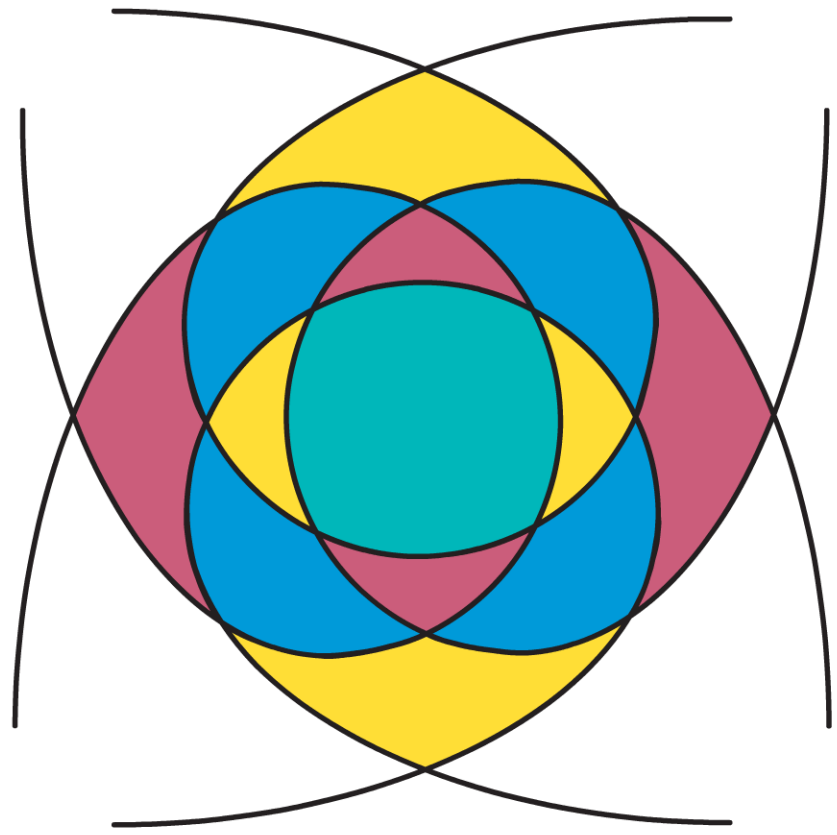

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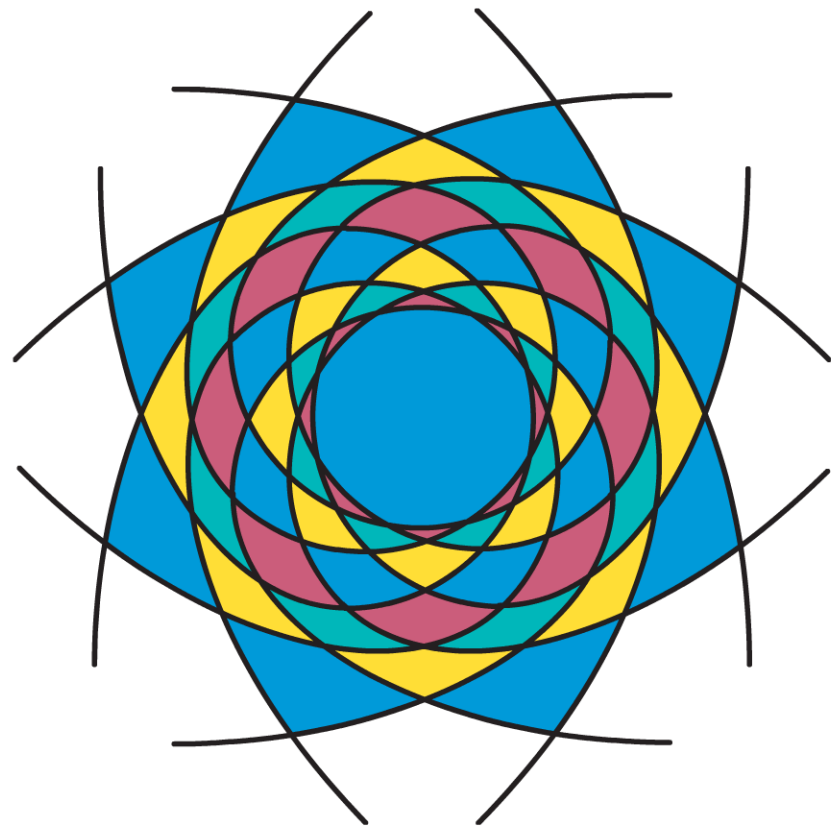

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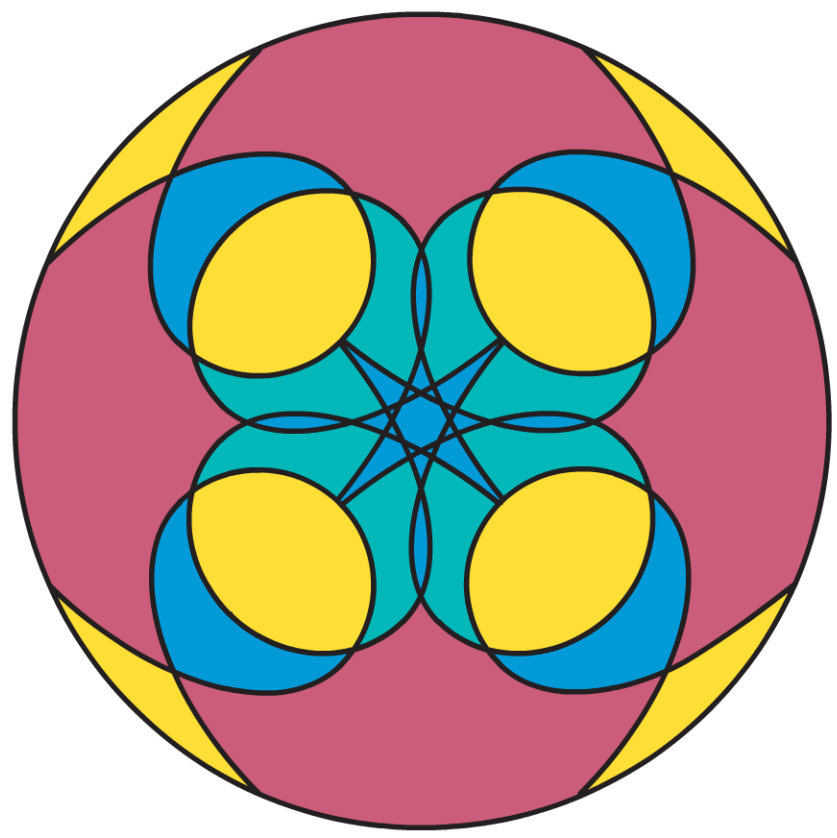

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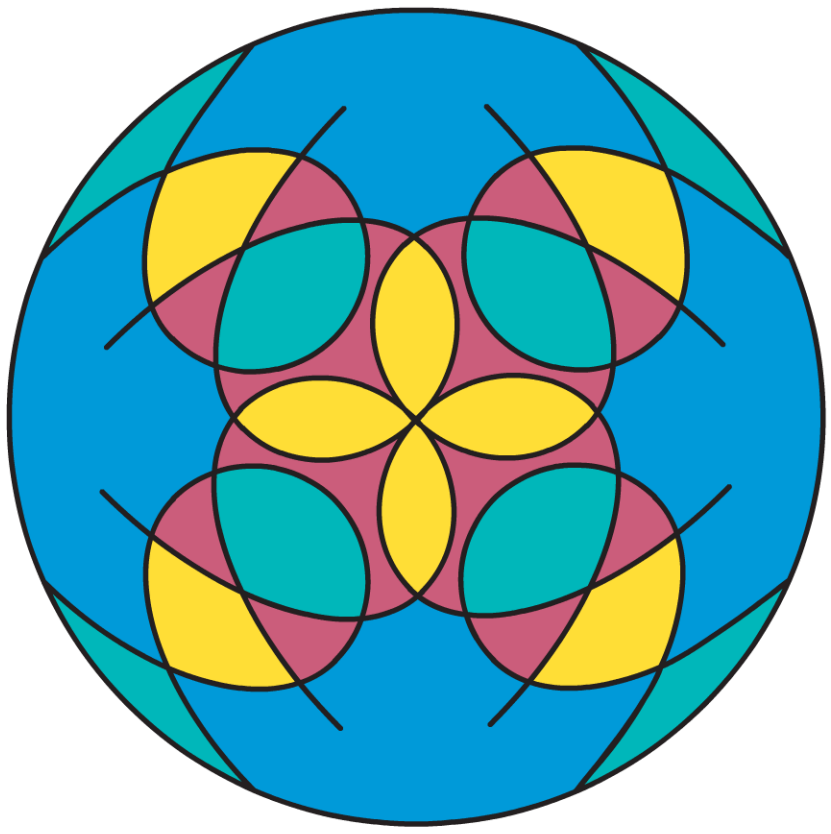

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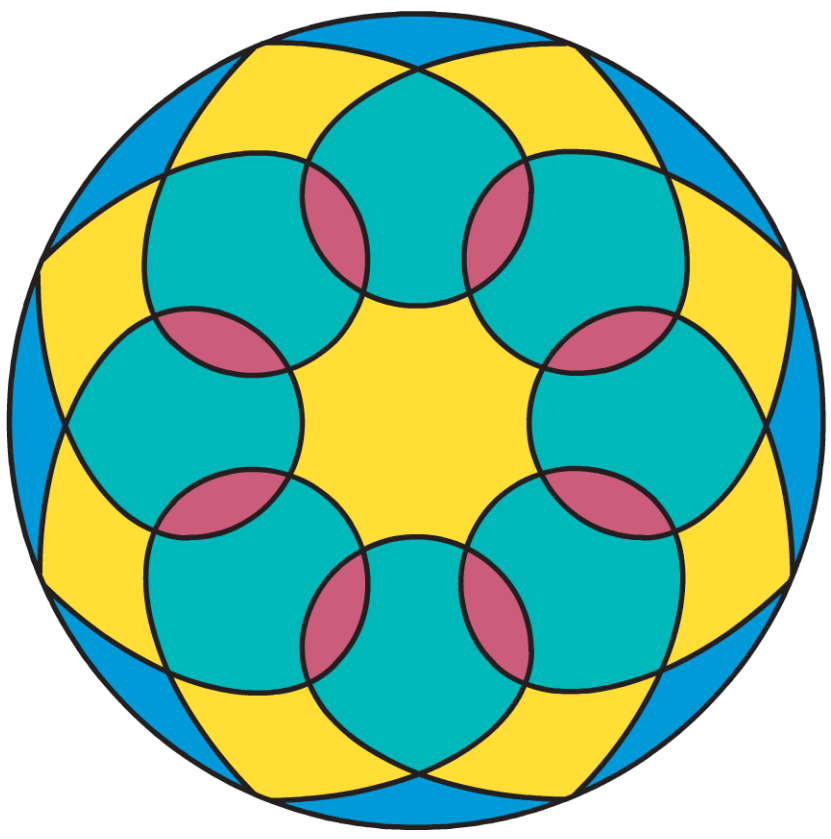

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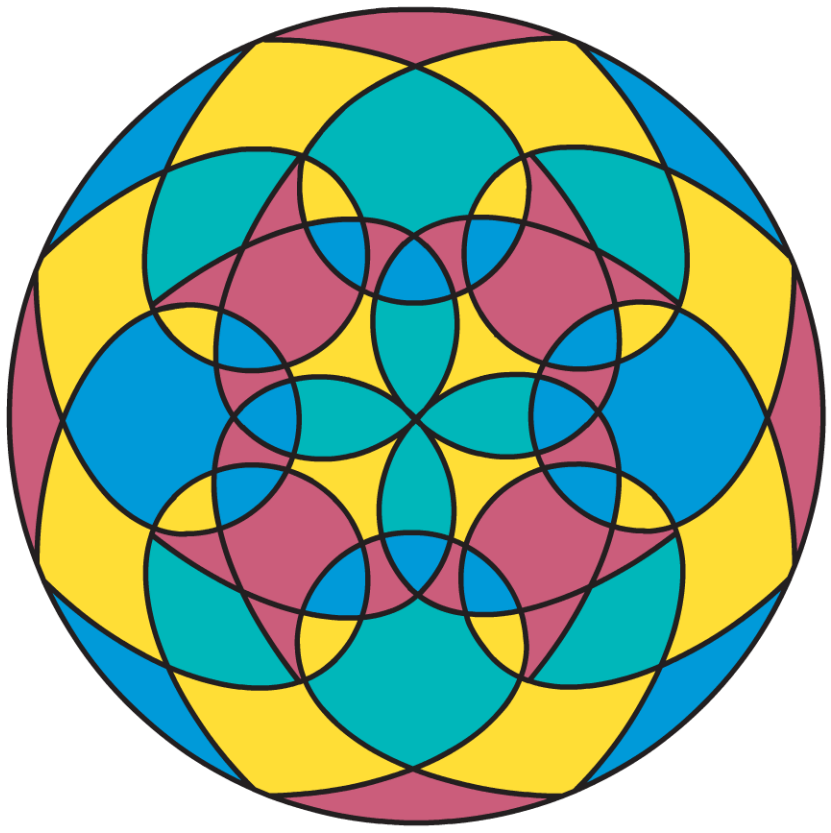

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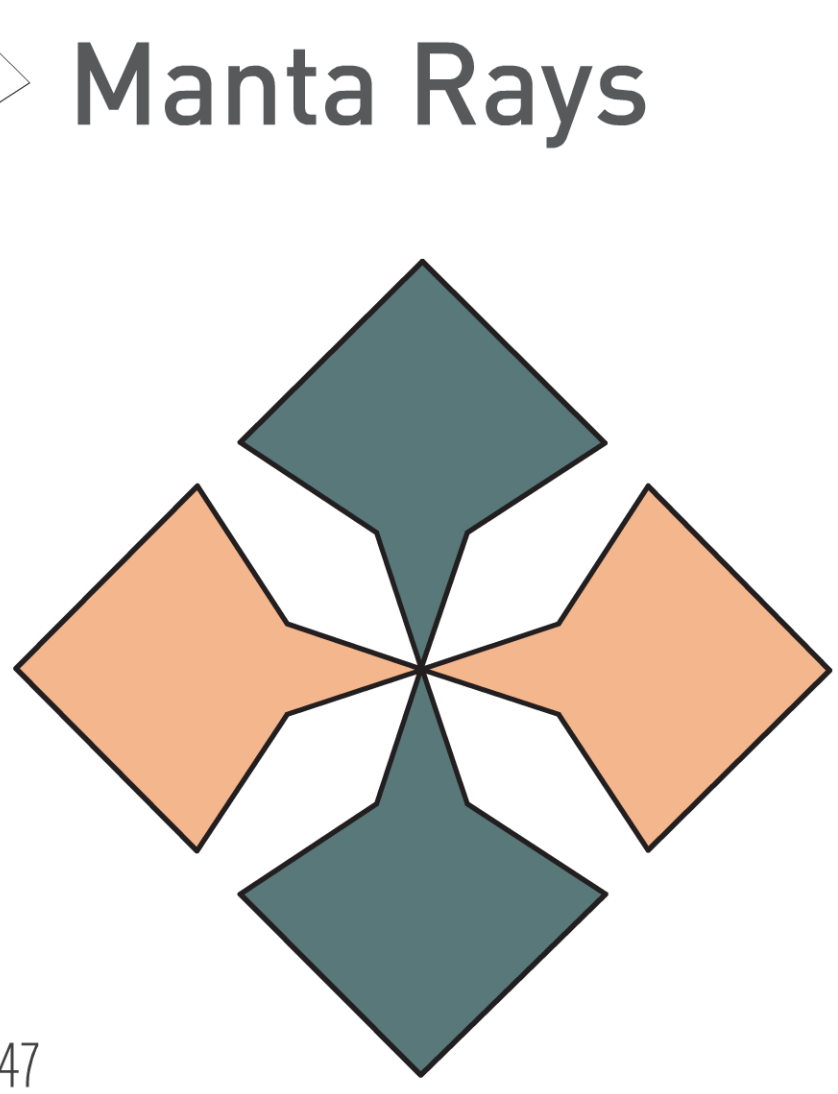

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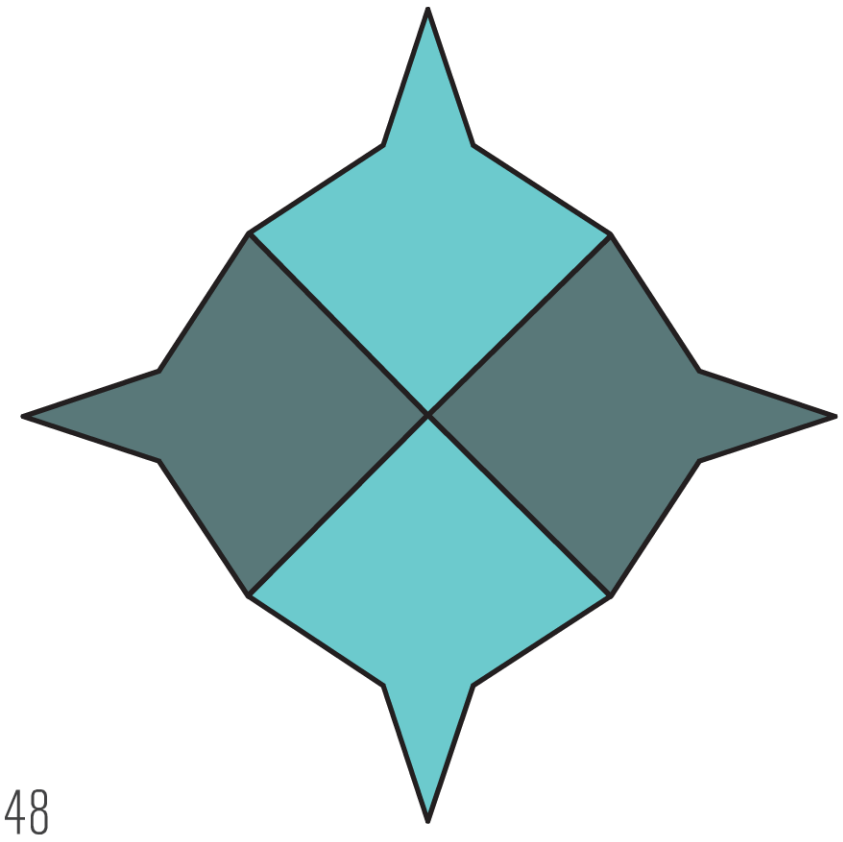

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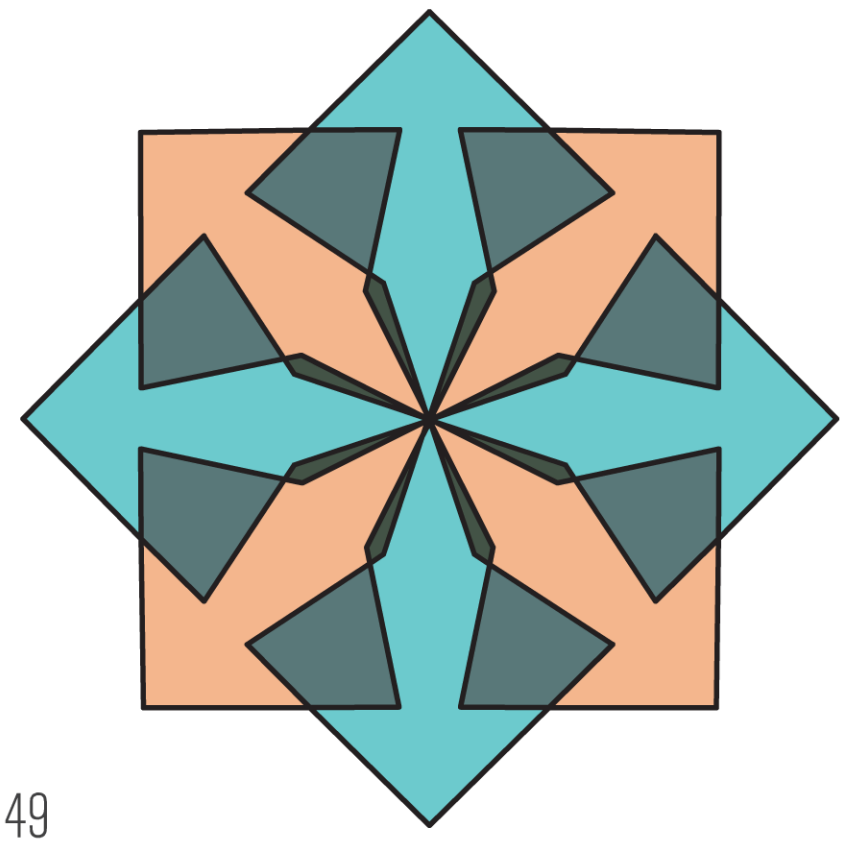

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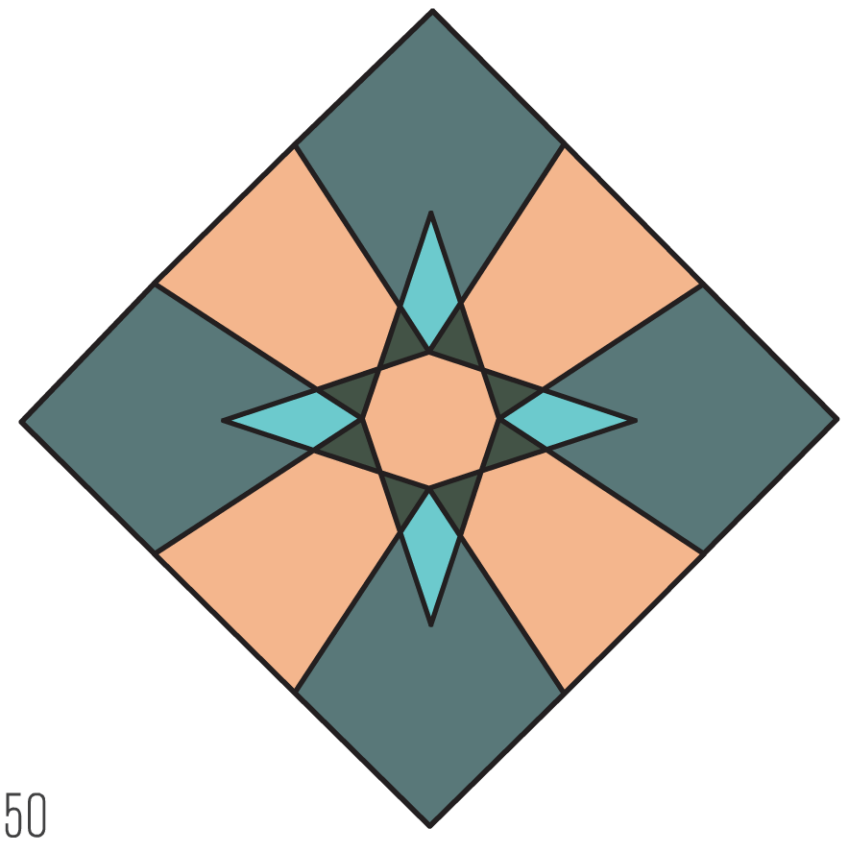

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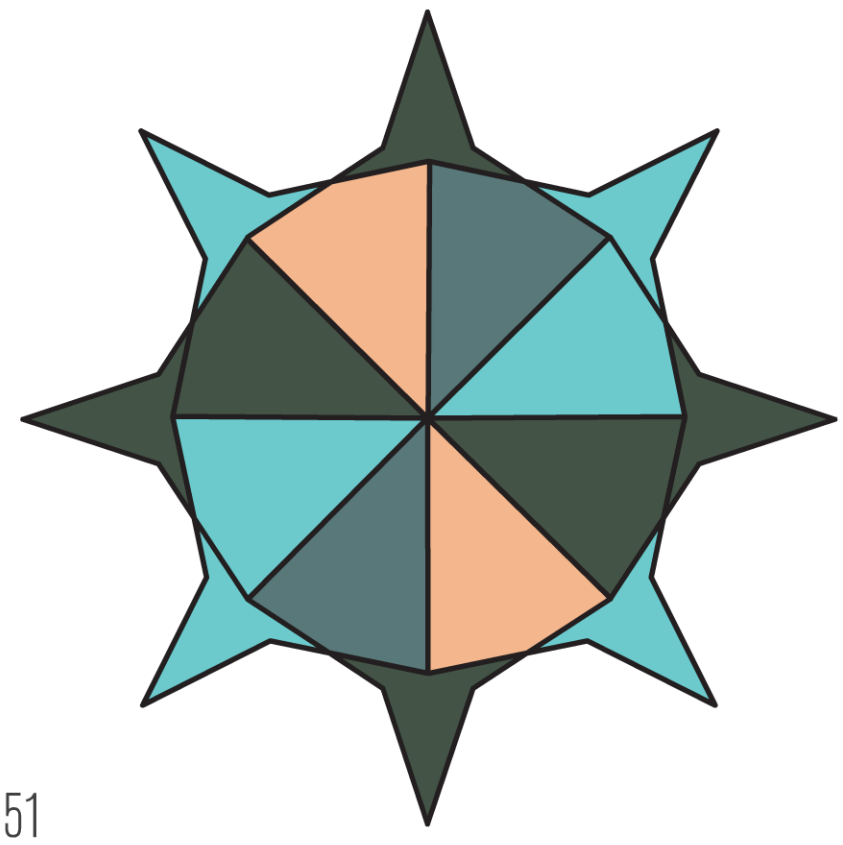

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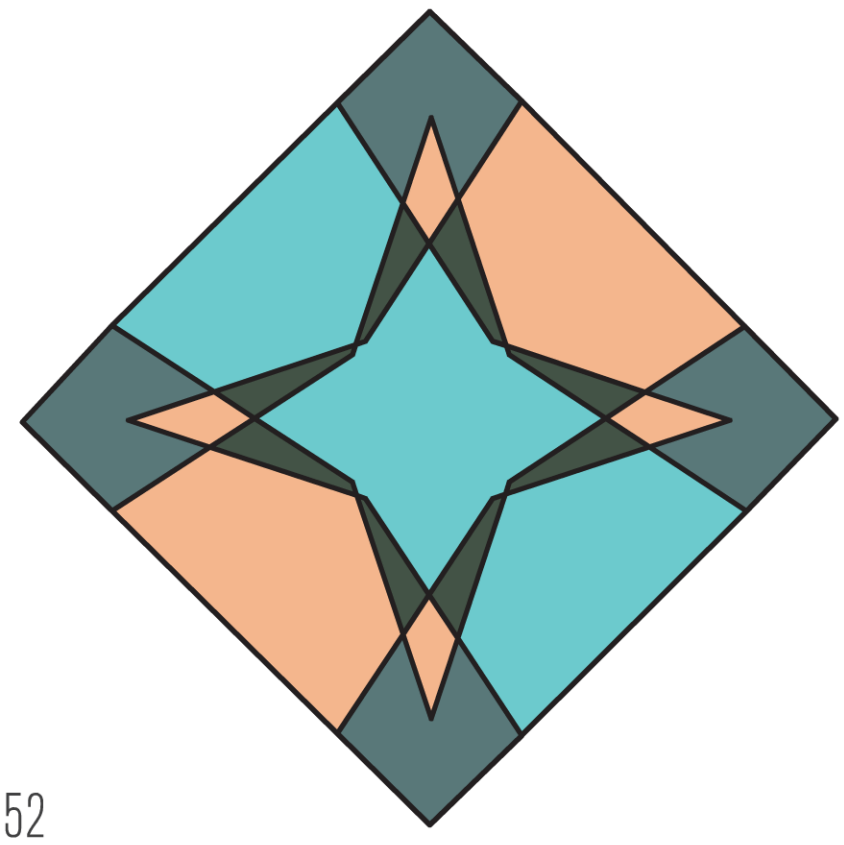

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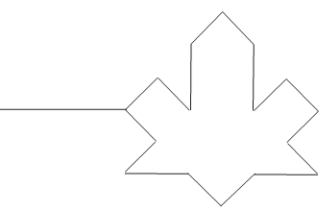
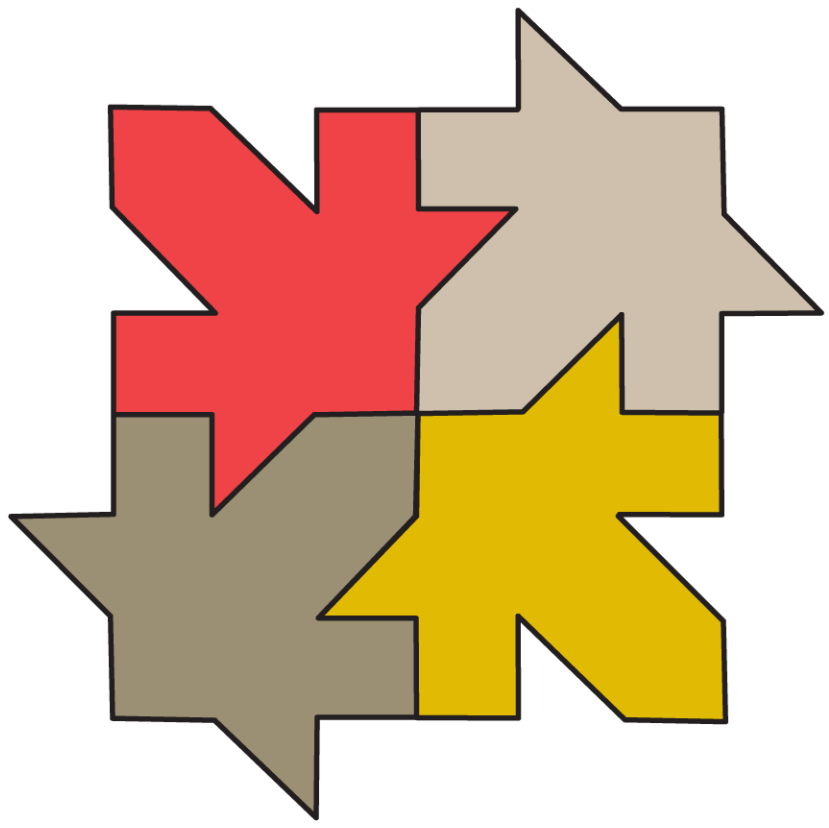


Maple Leaf



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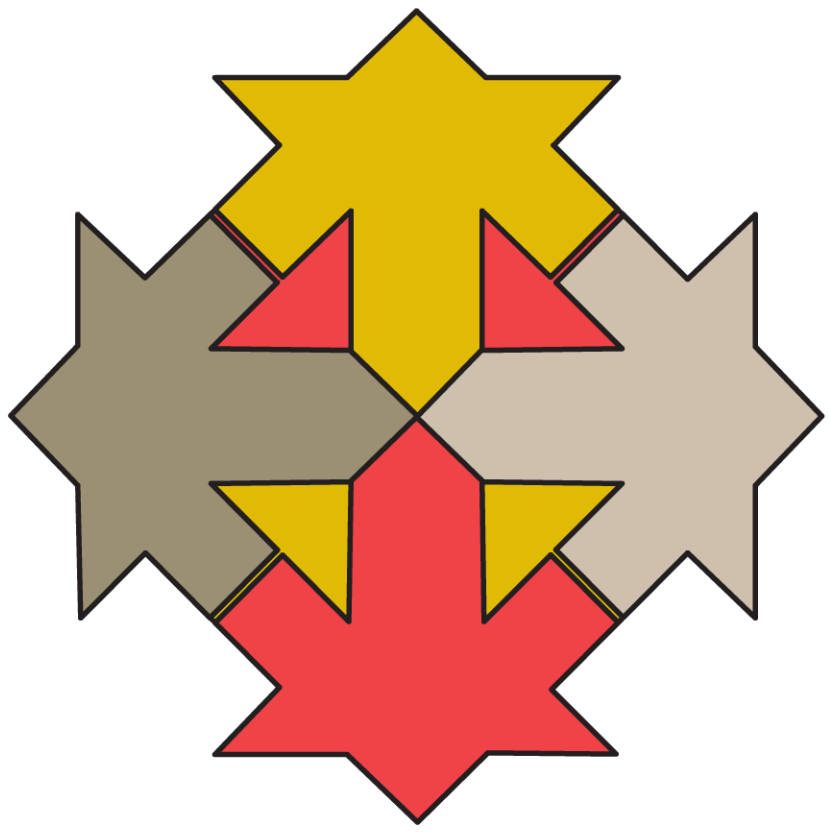

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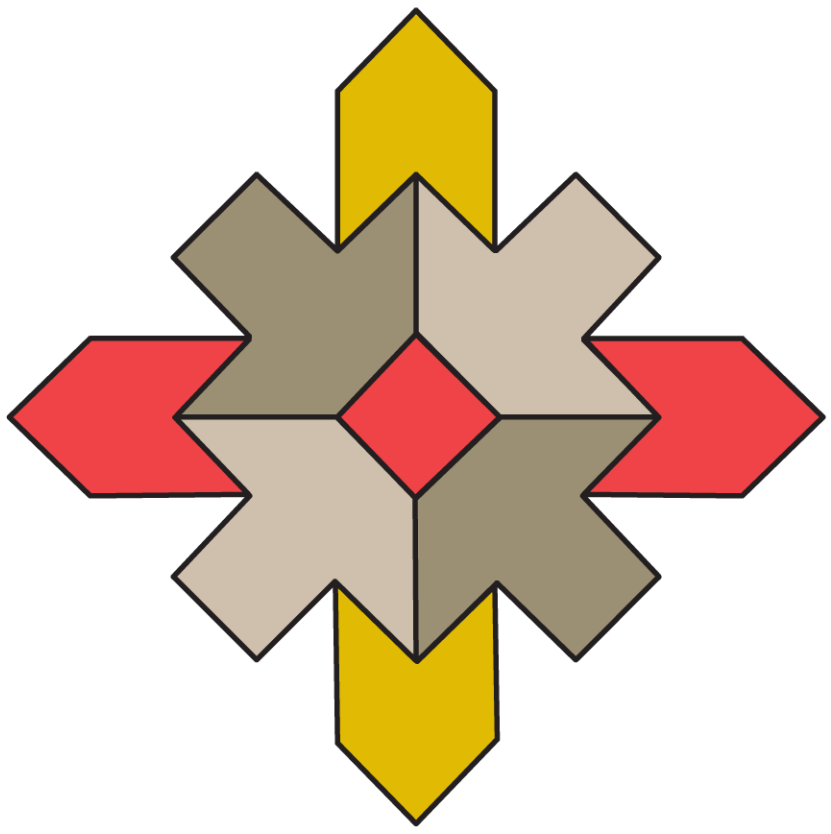

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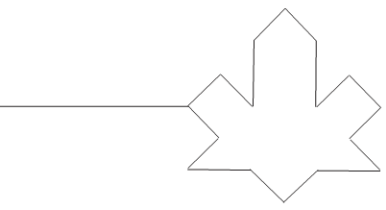

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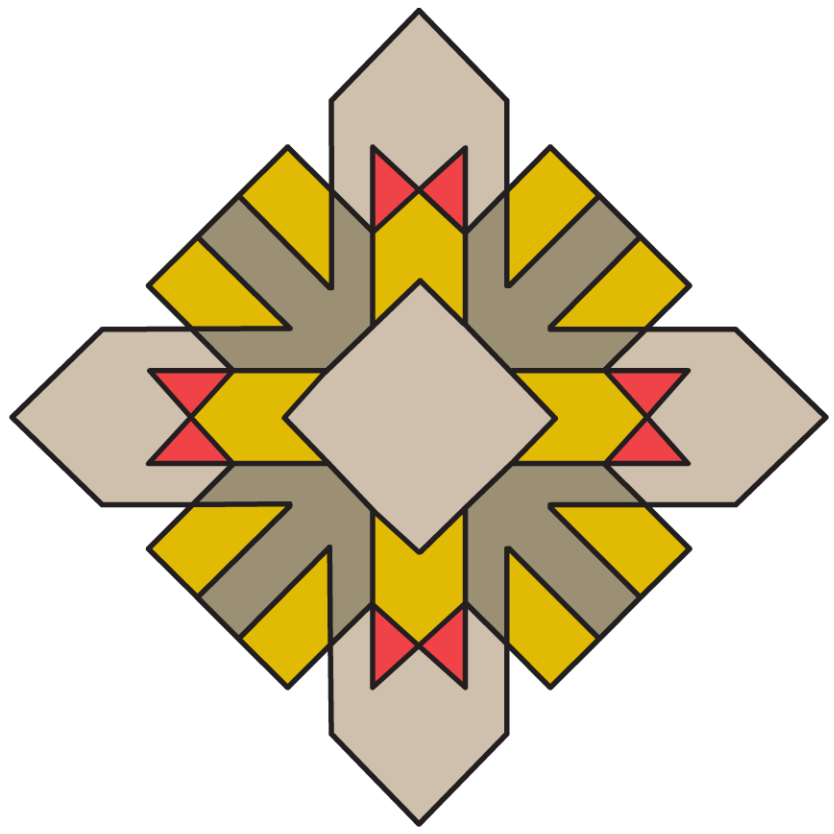

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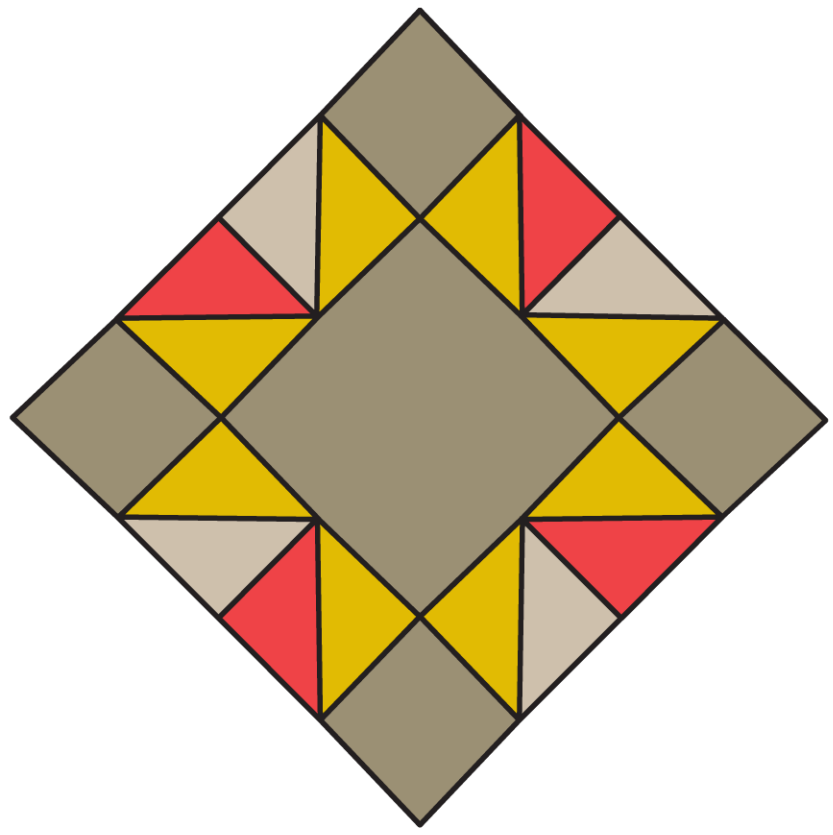

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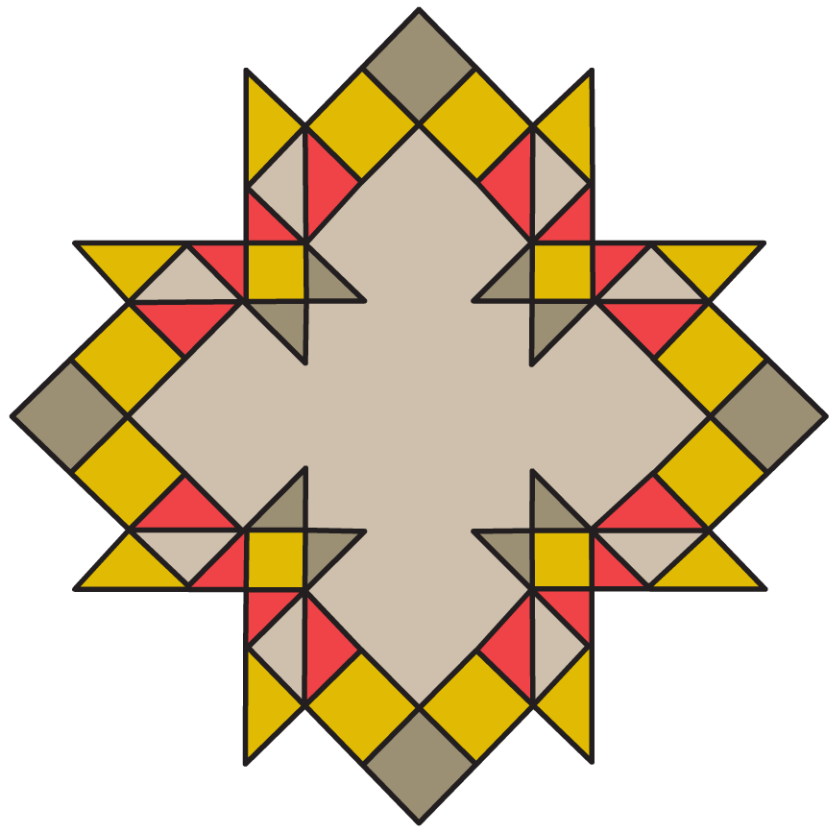

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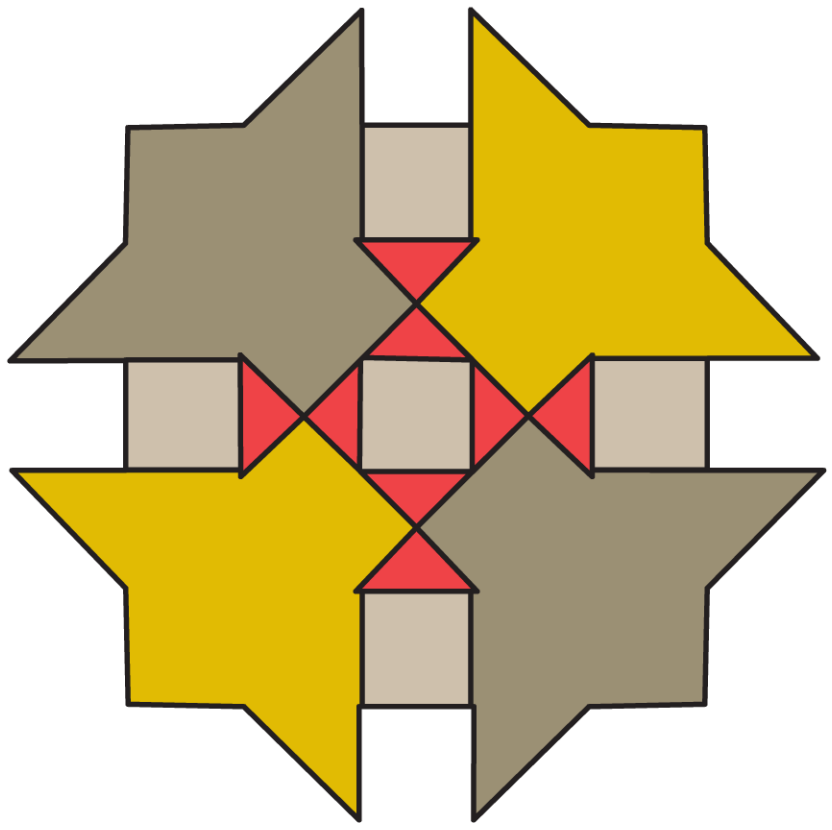

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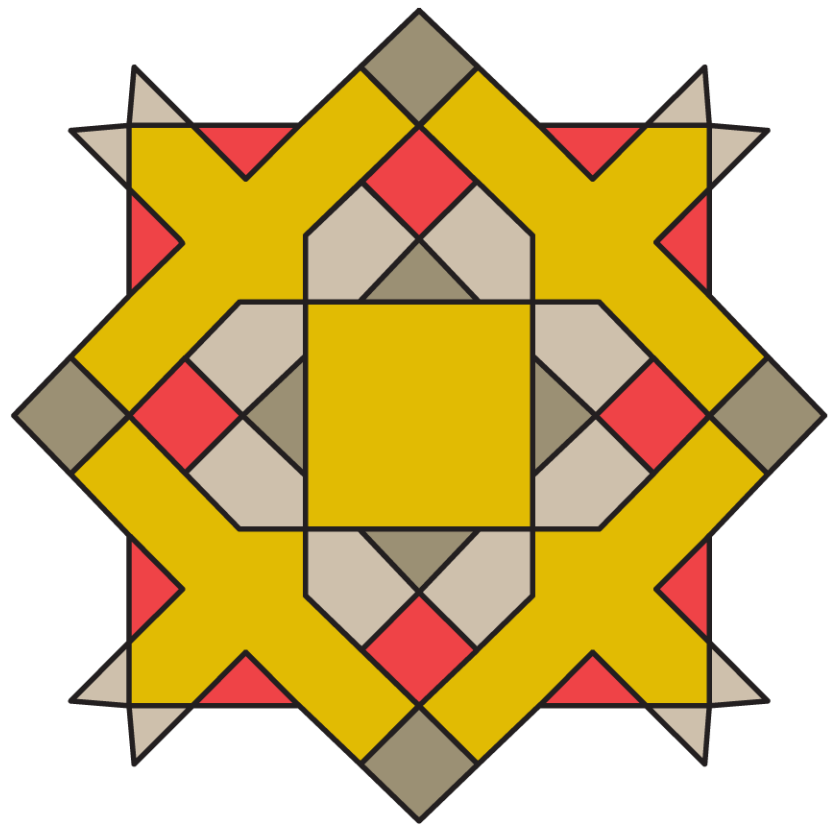

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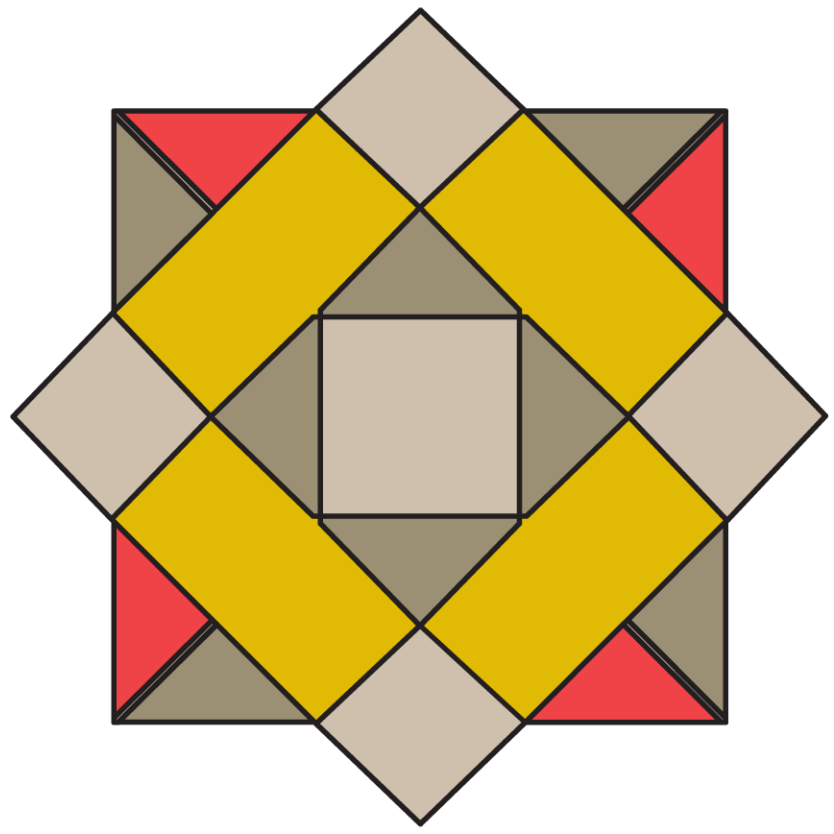

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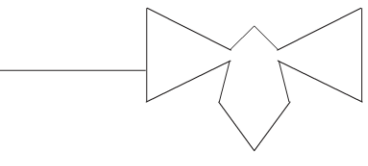
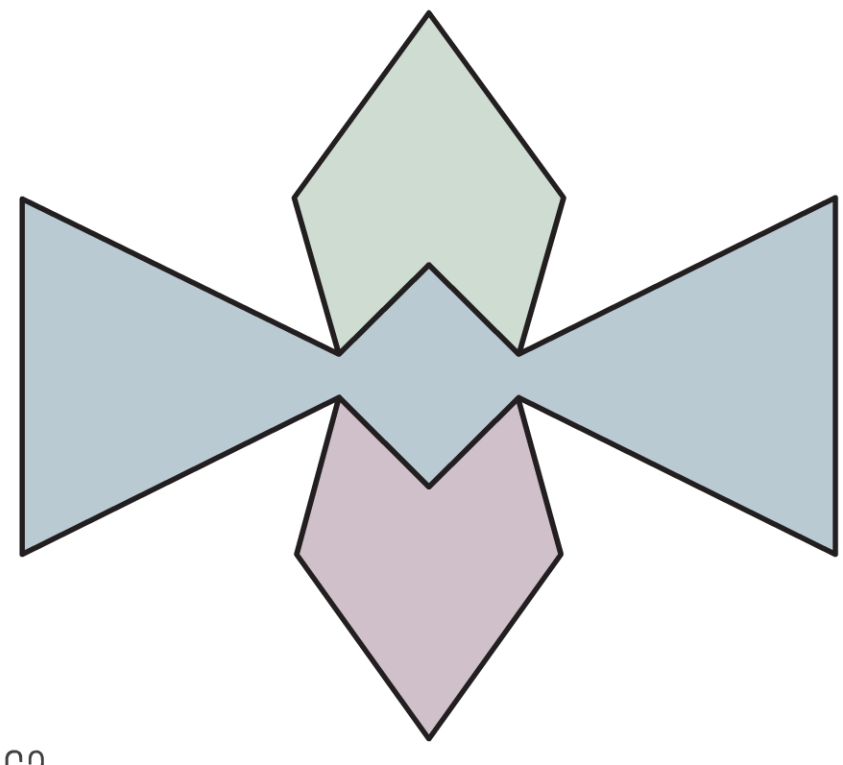


Moths



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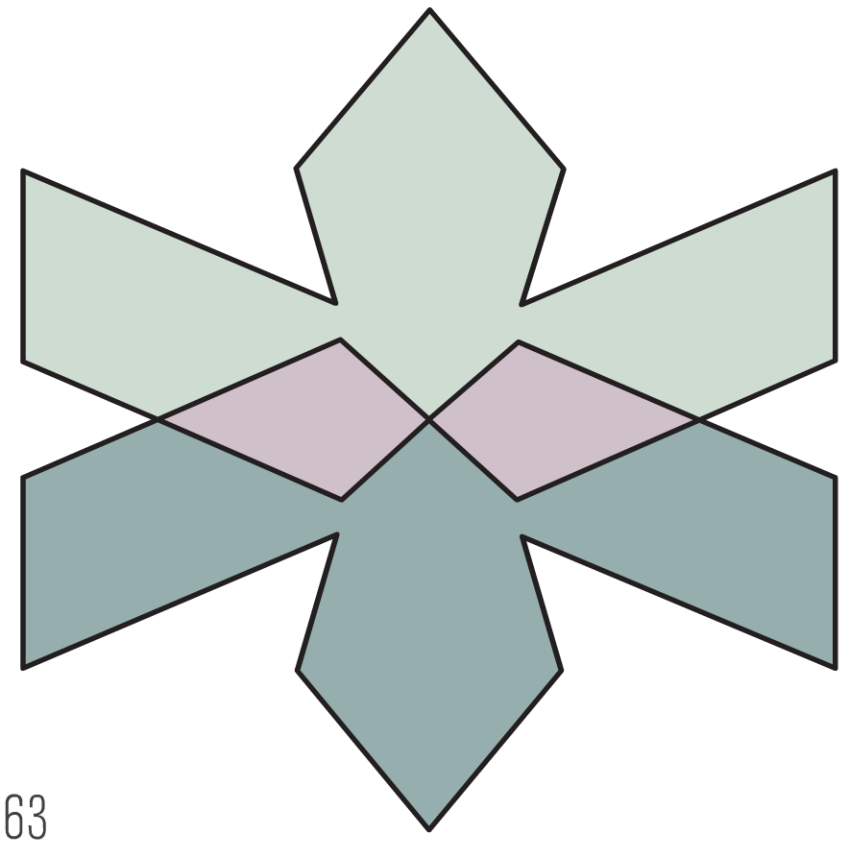

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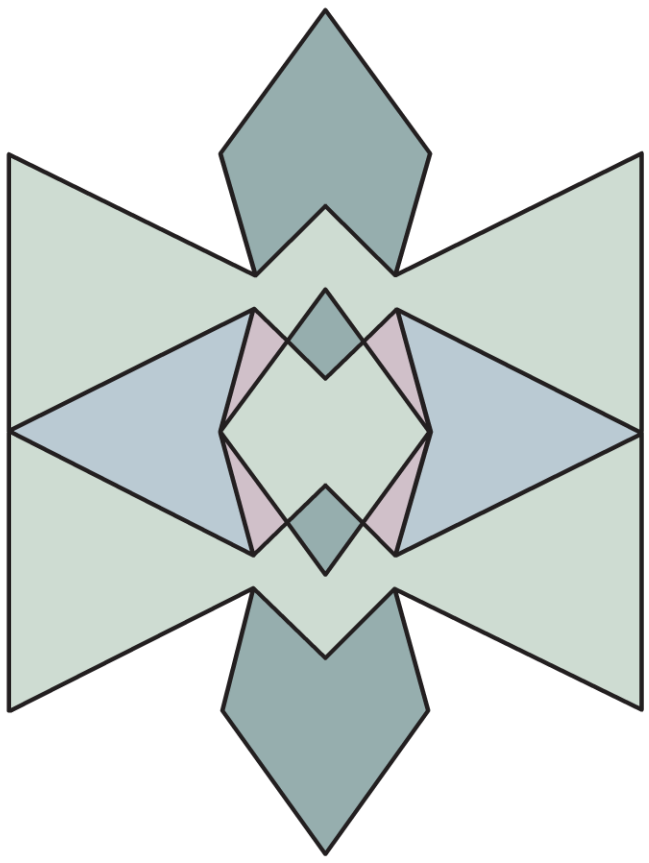

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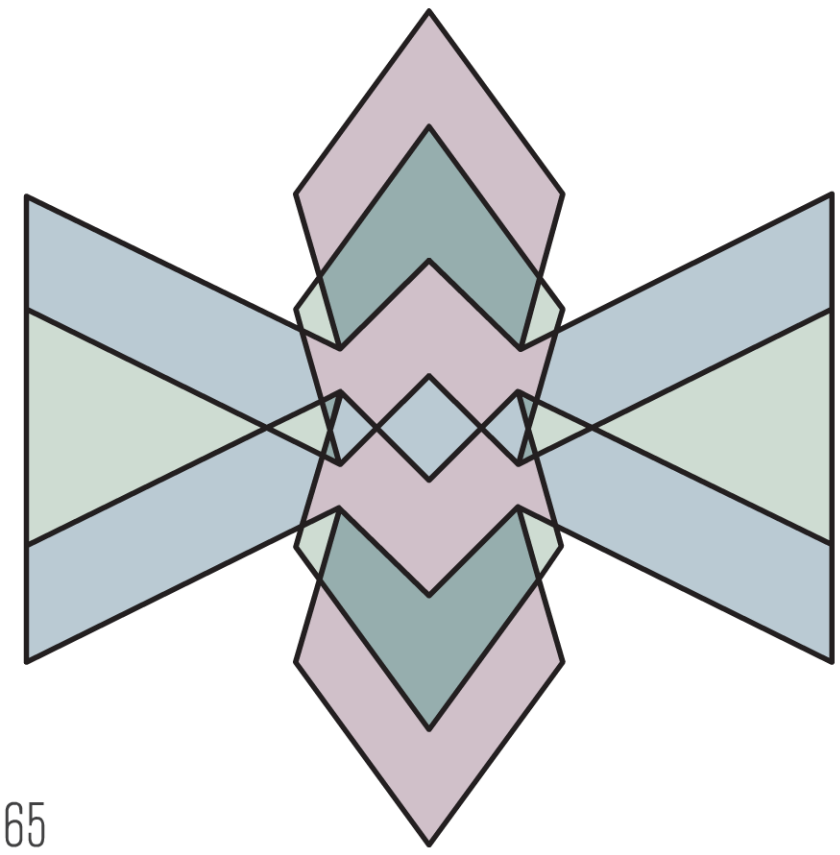

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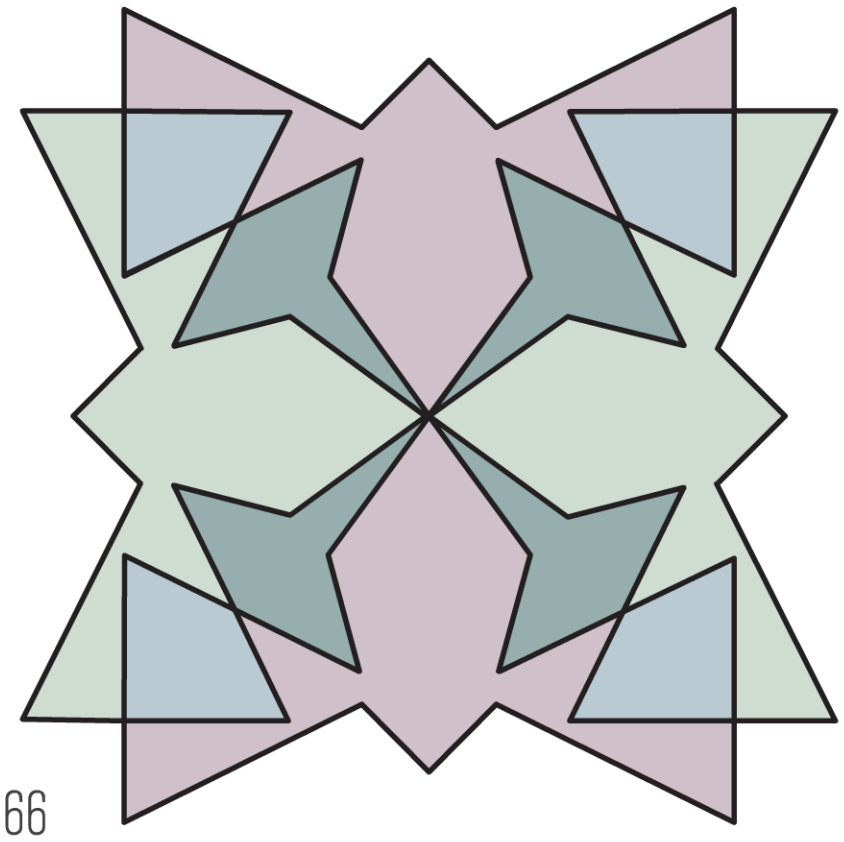

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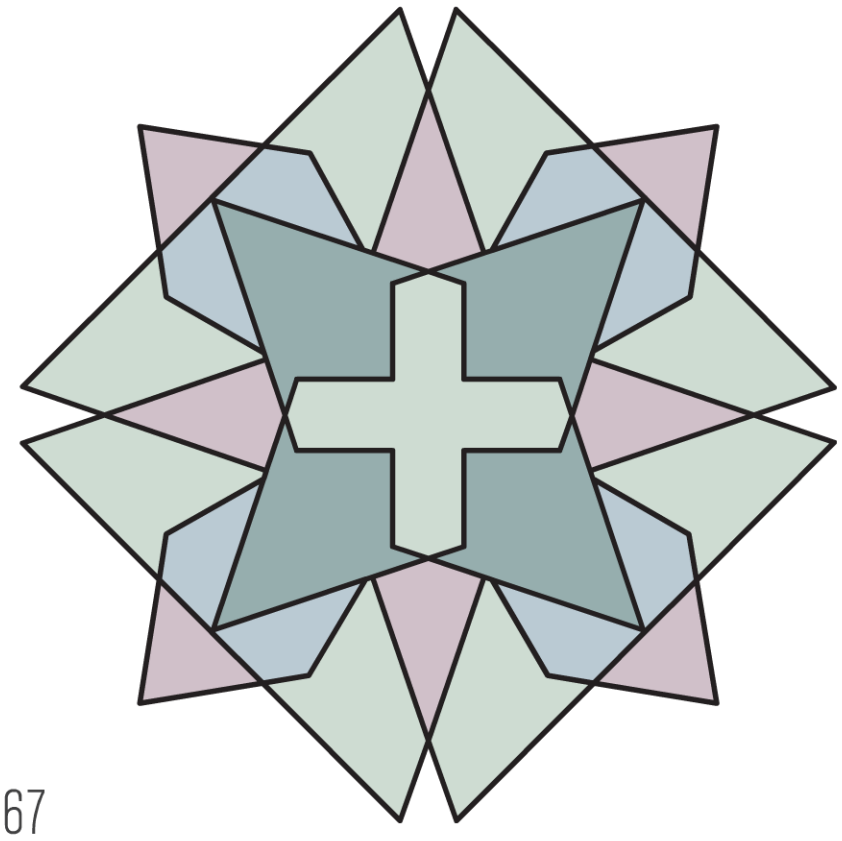

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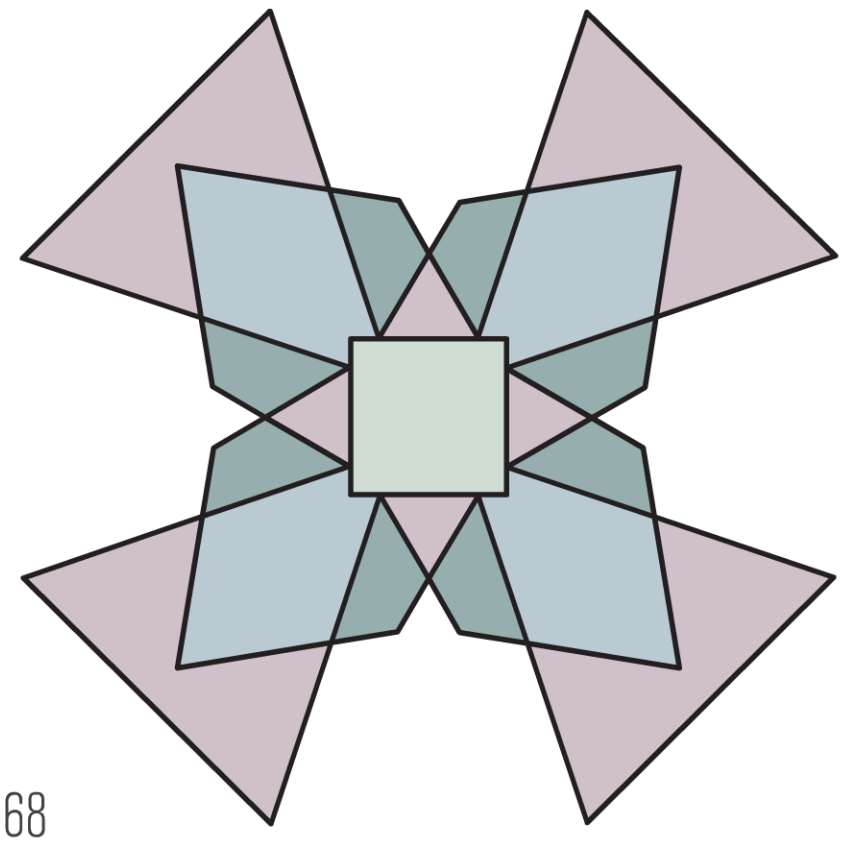

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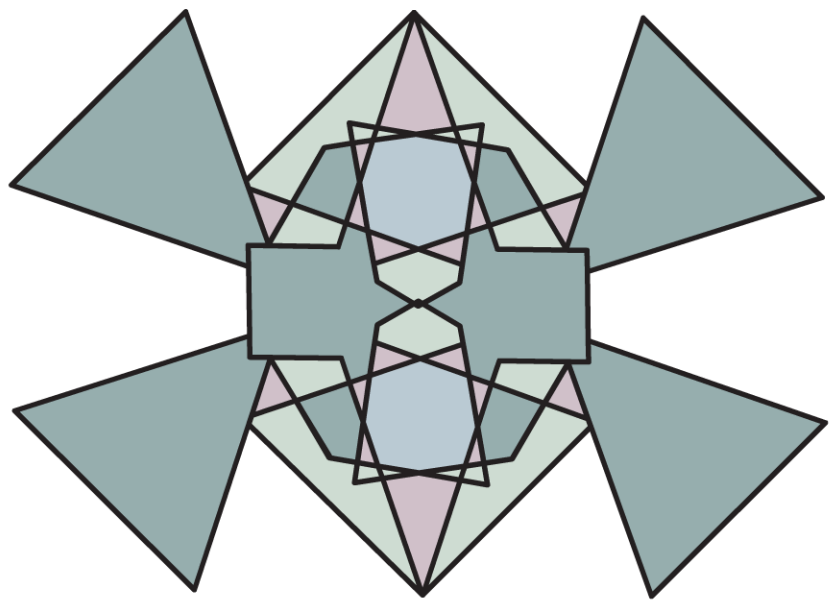

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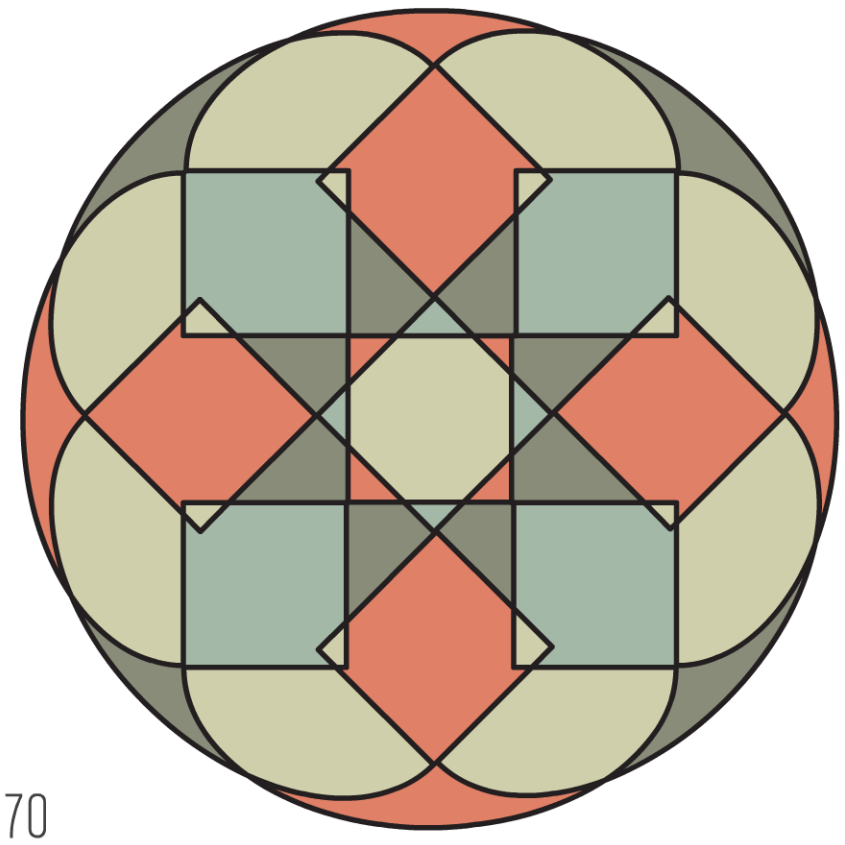
Mushrooms



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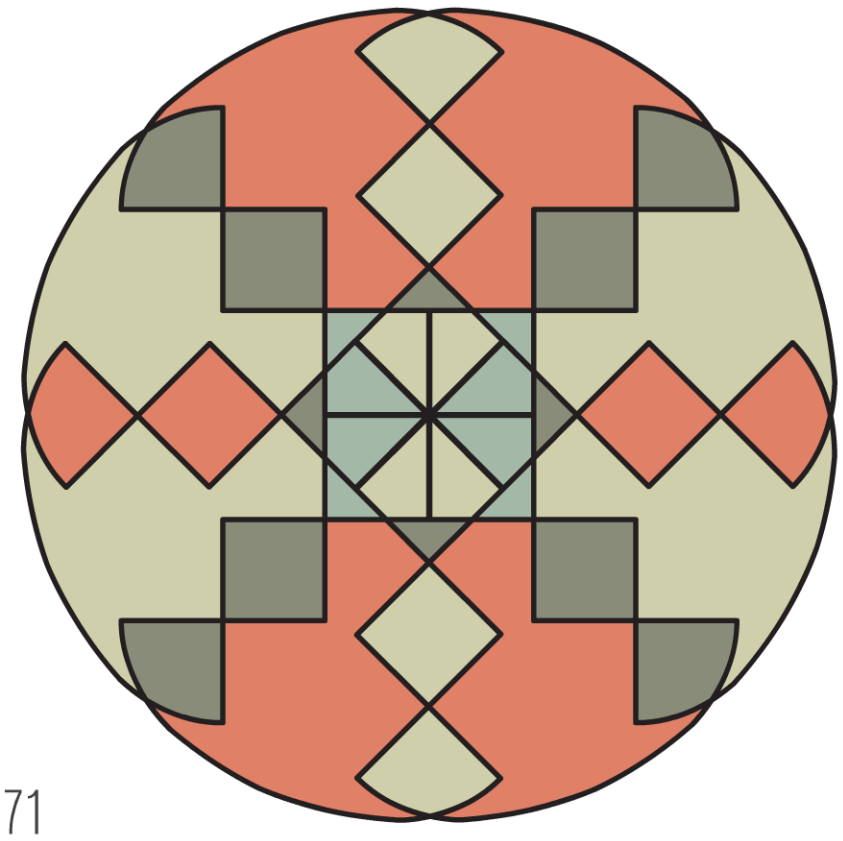

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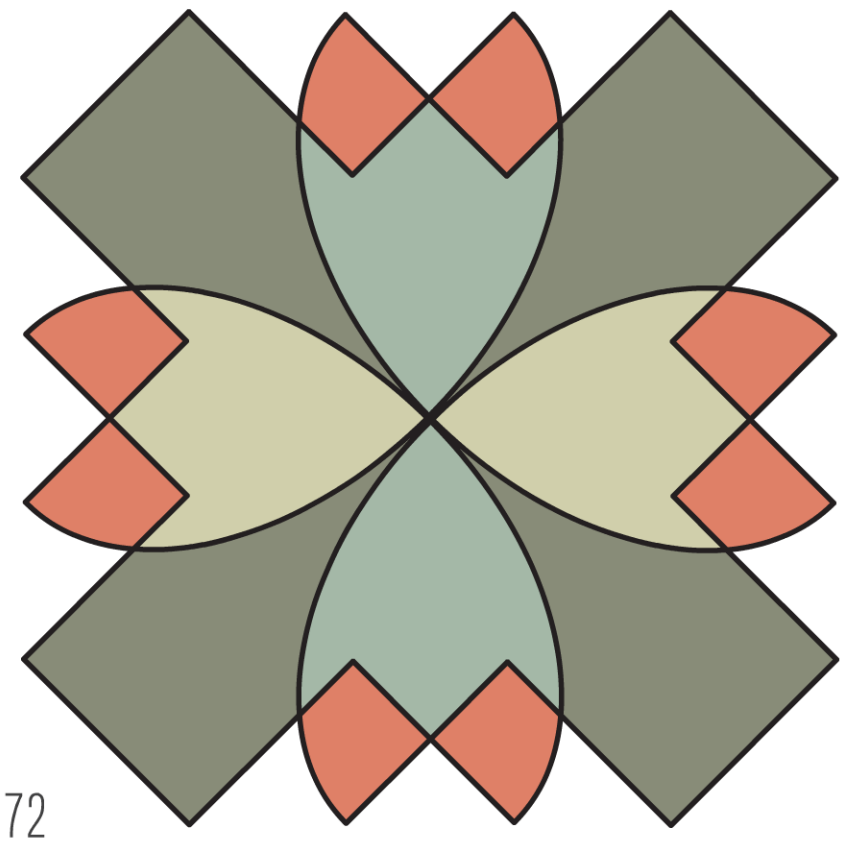

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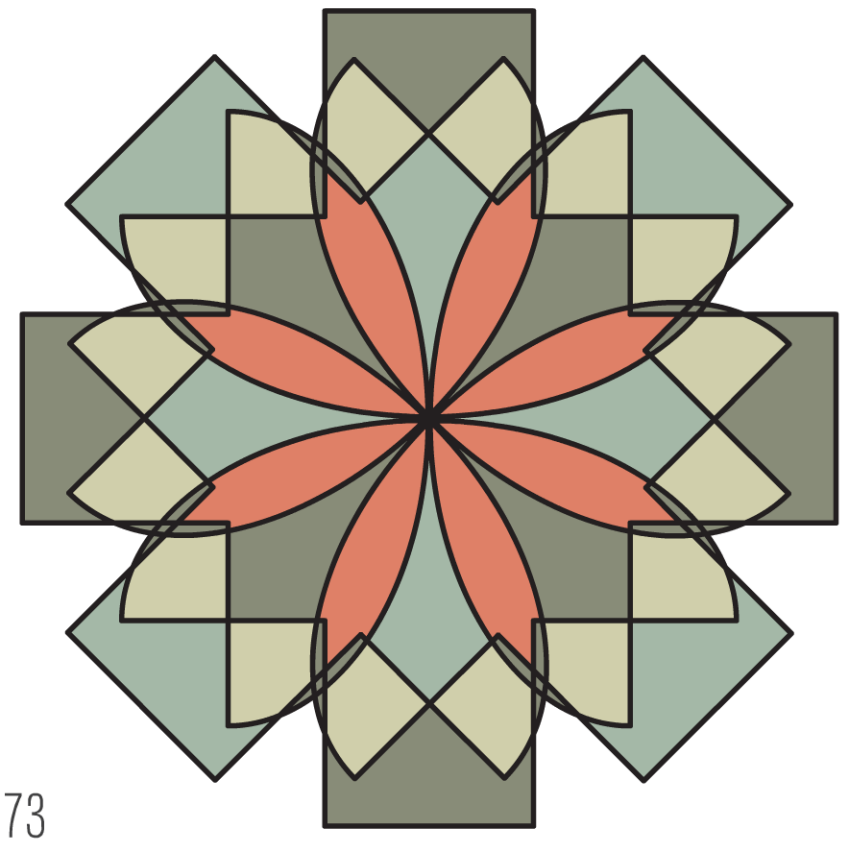

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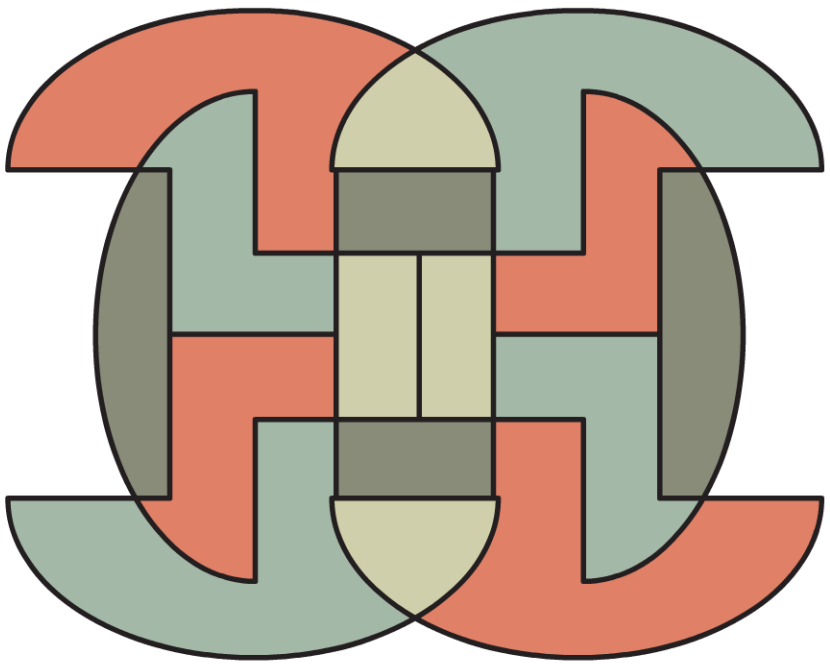

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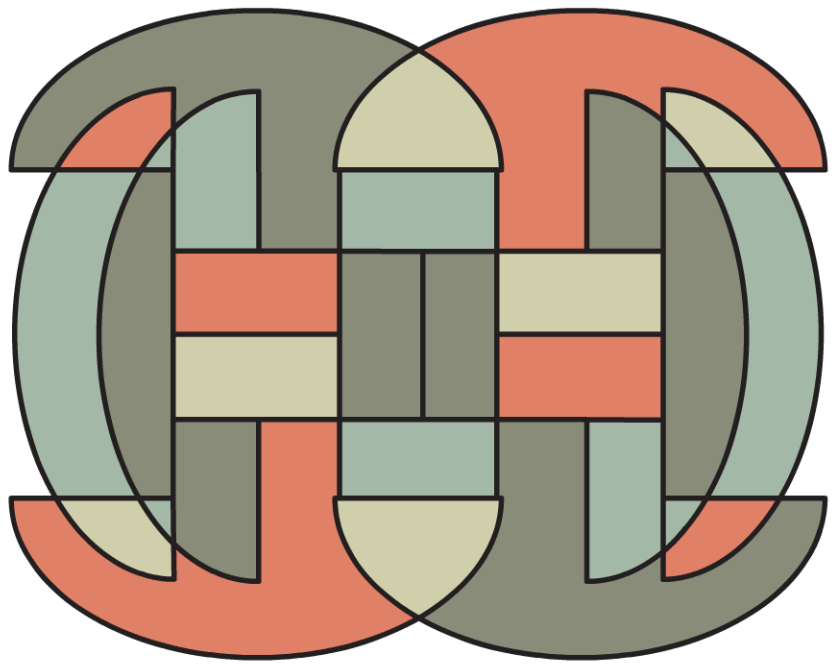

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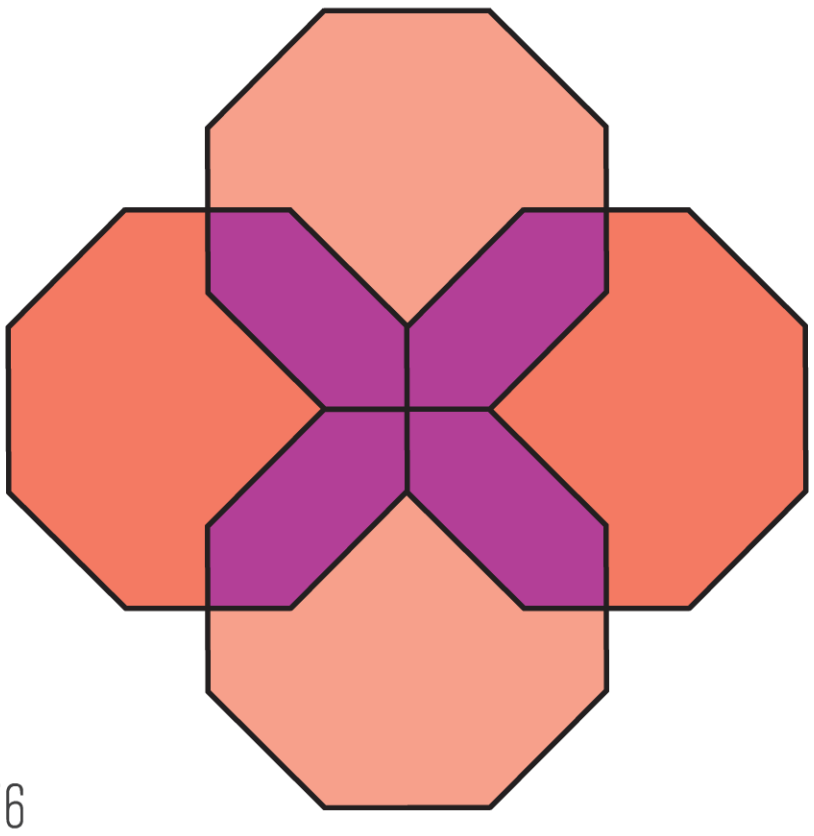
Octagons



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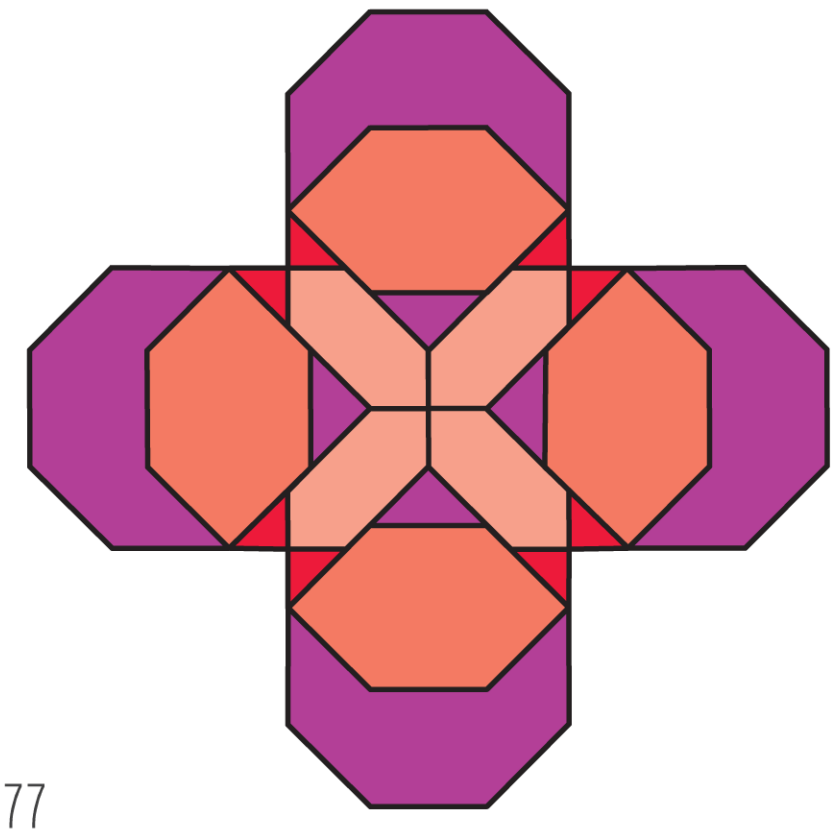

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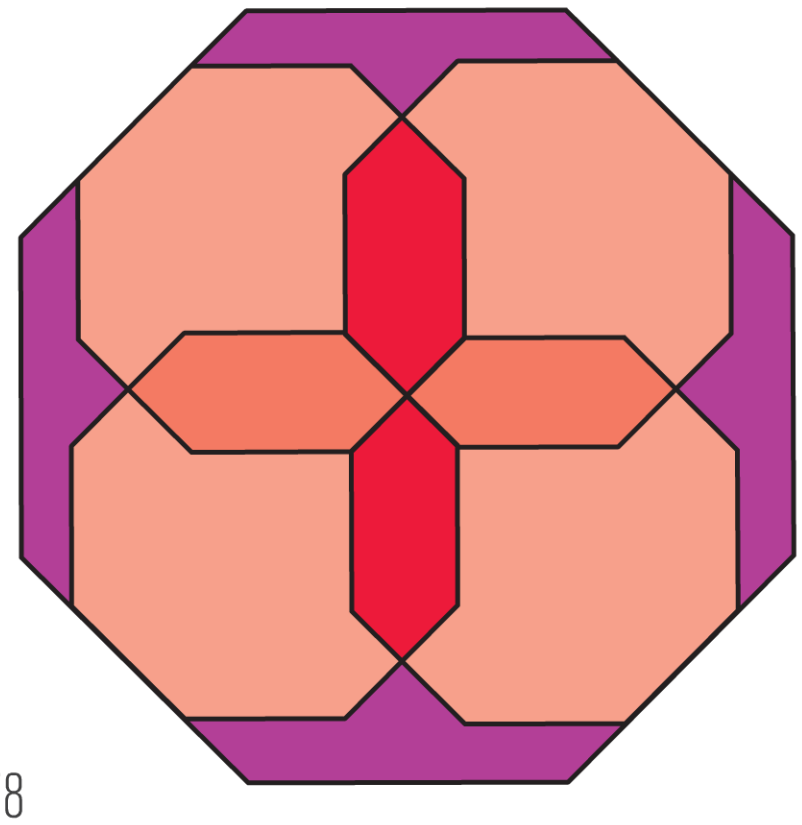

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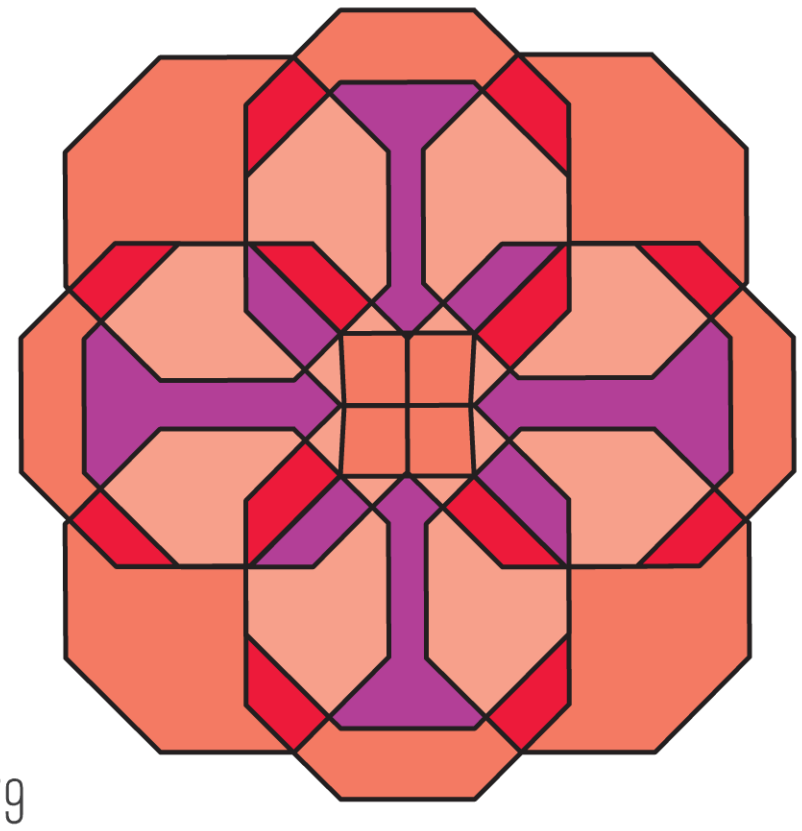

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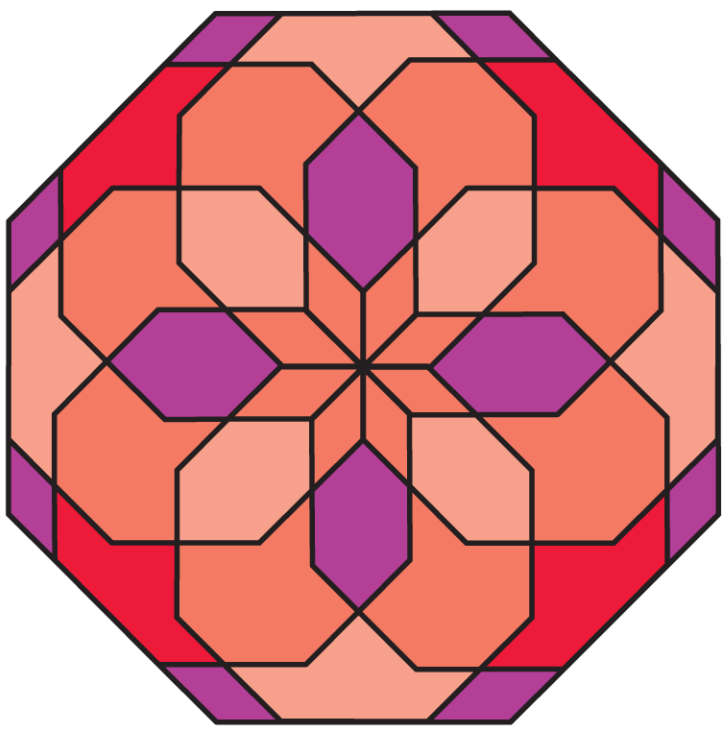

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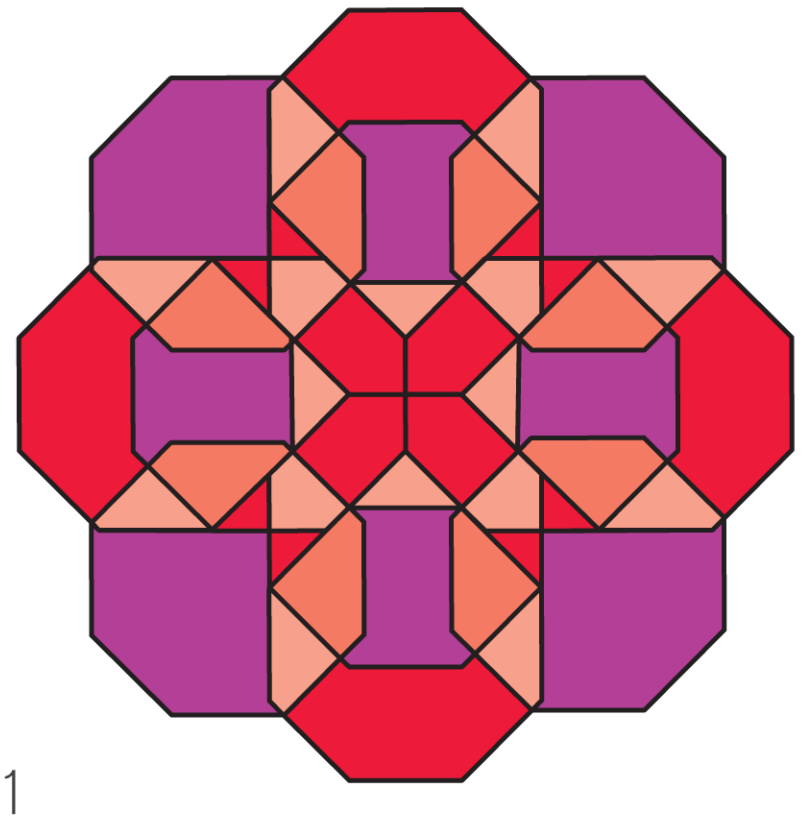

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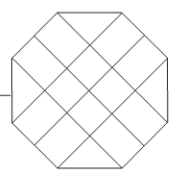
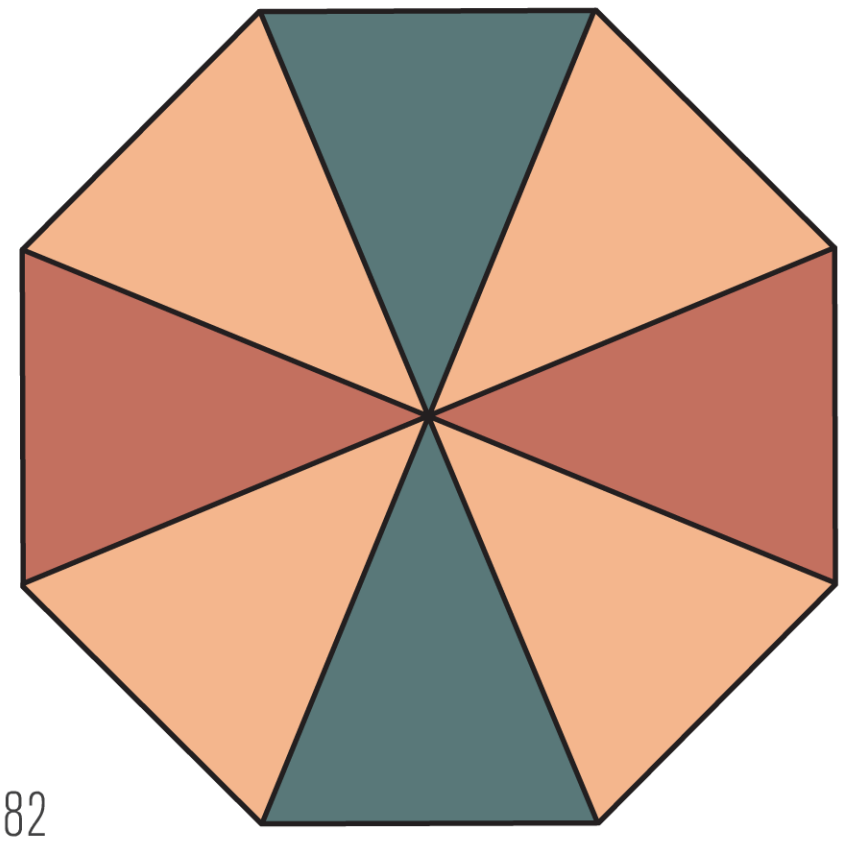


Octagons Divided



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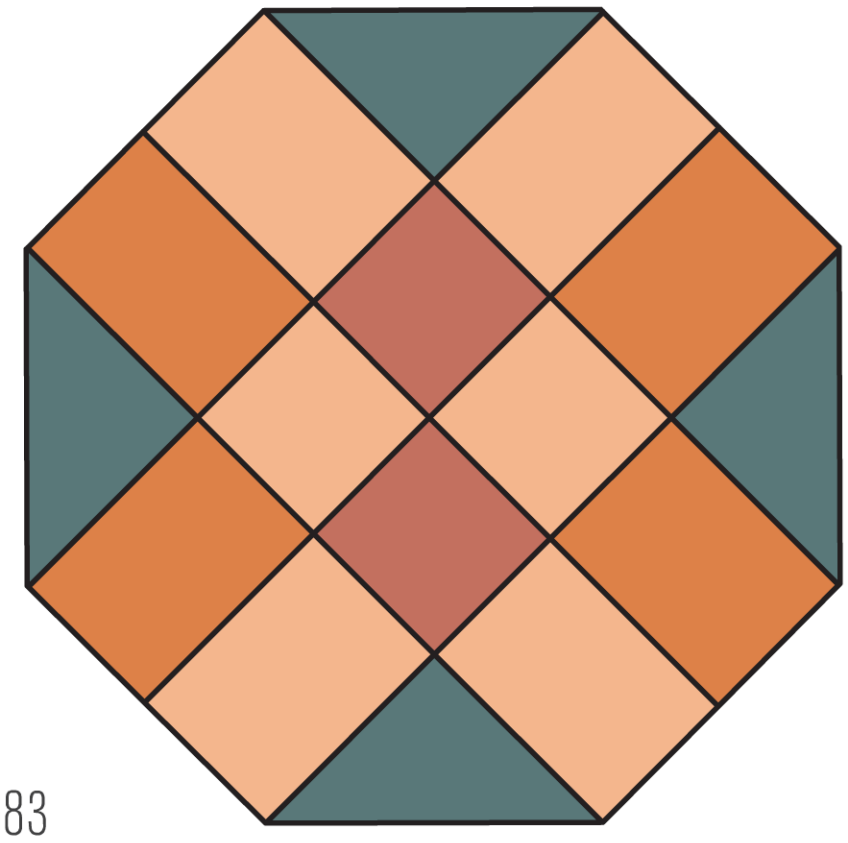

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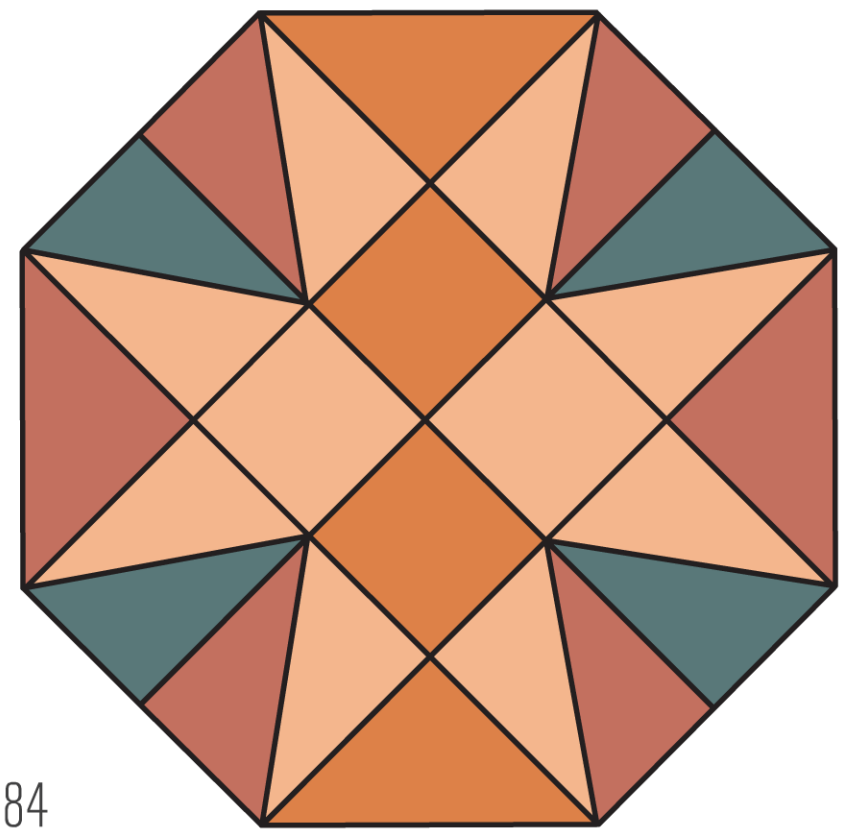

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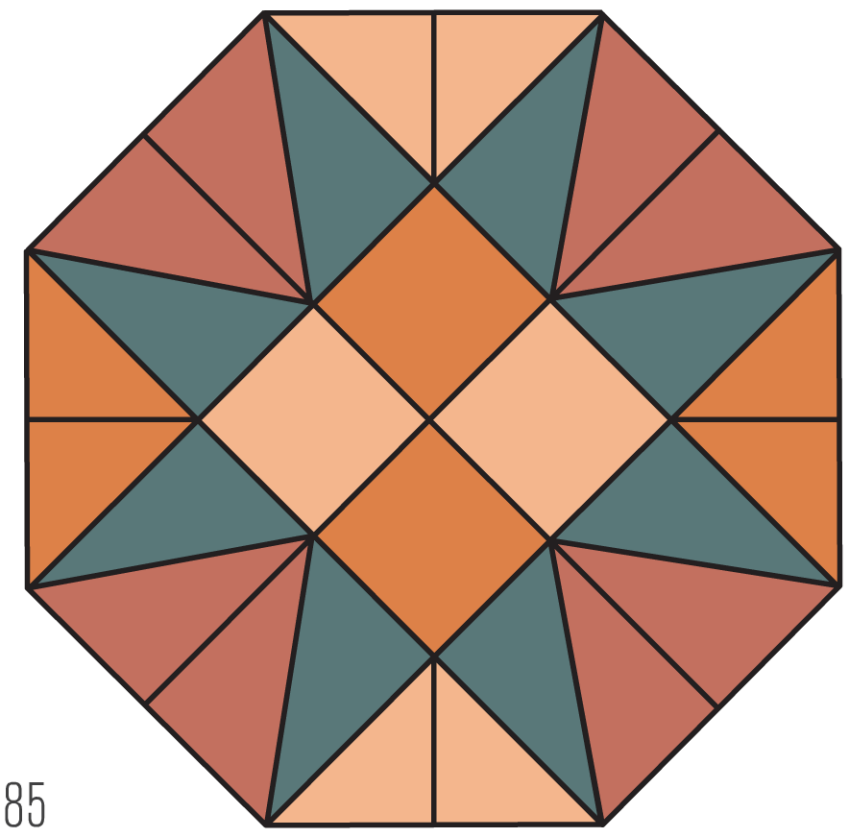

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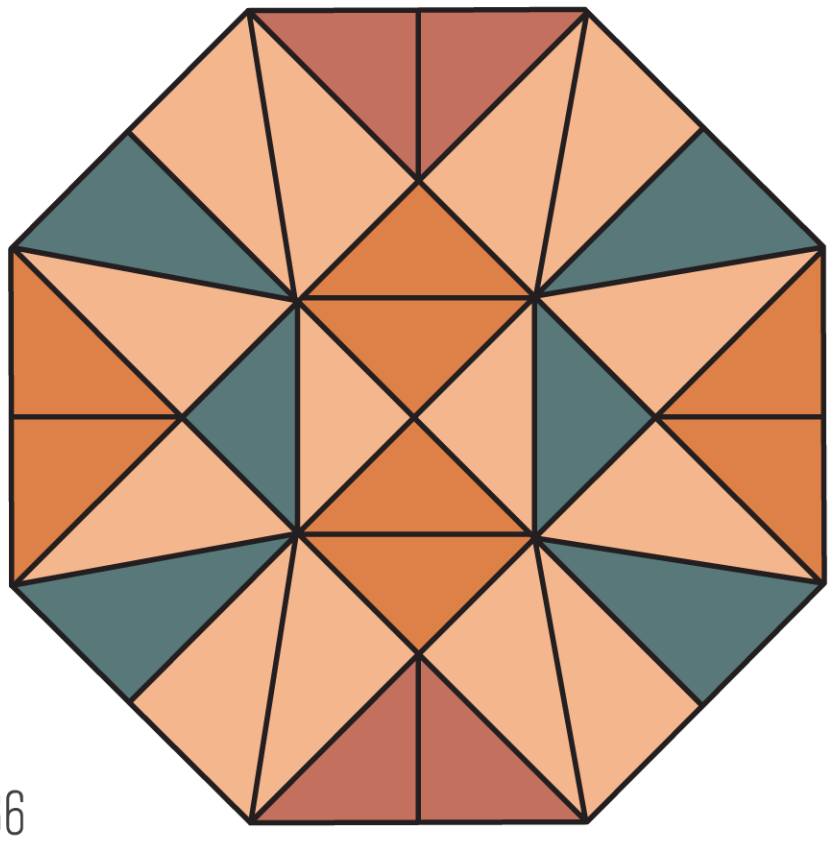

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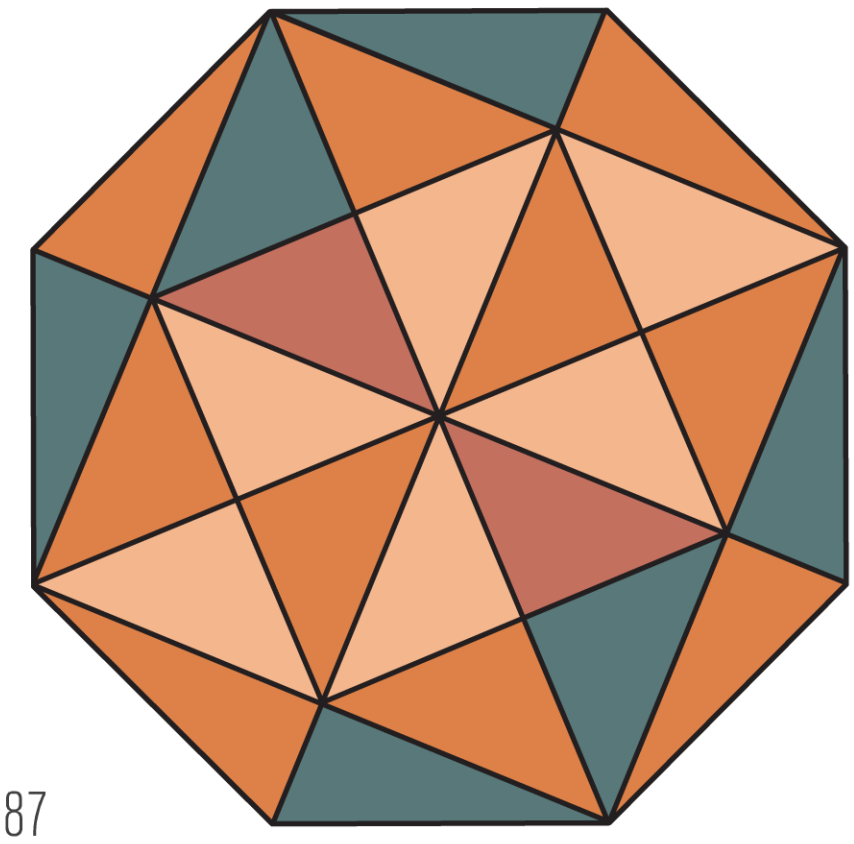

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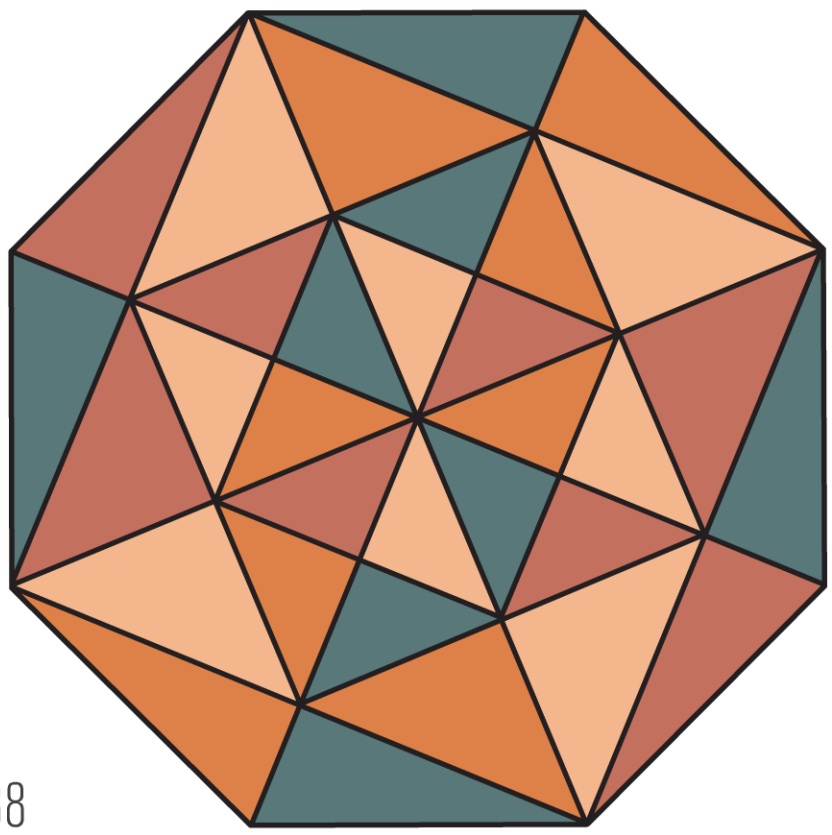

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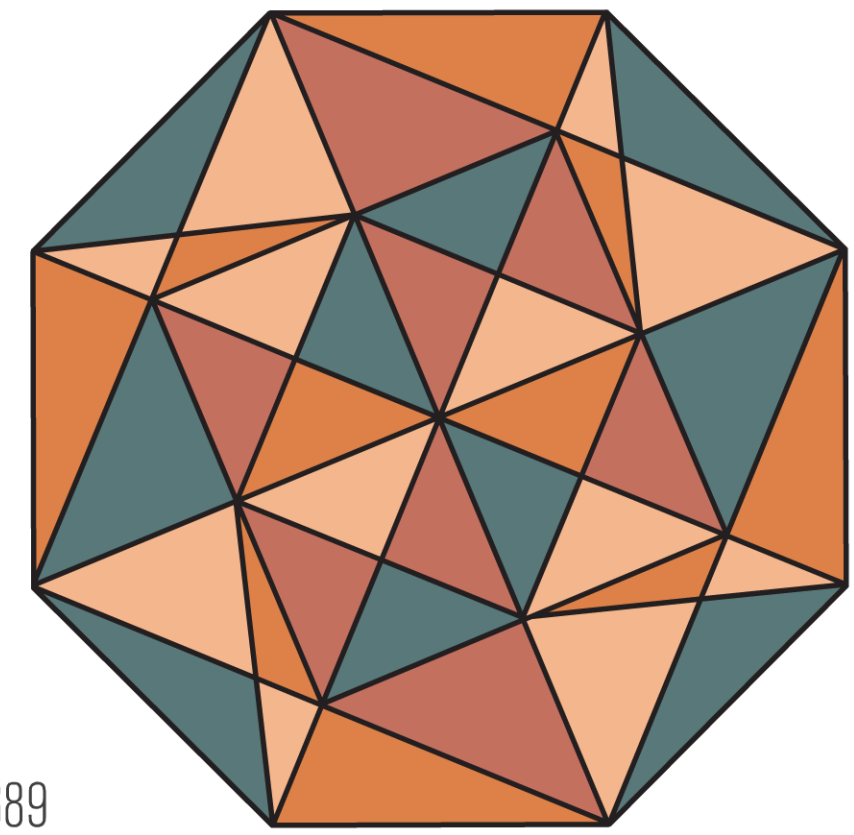

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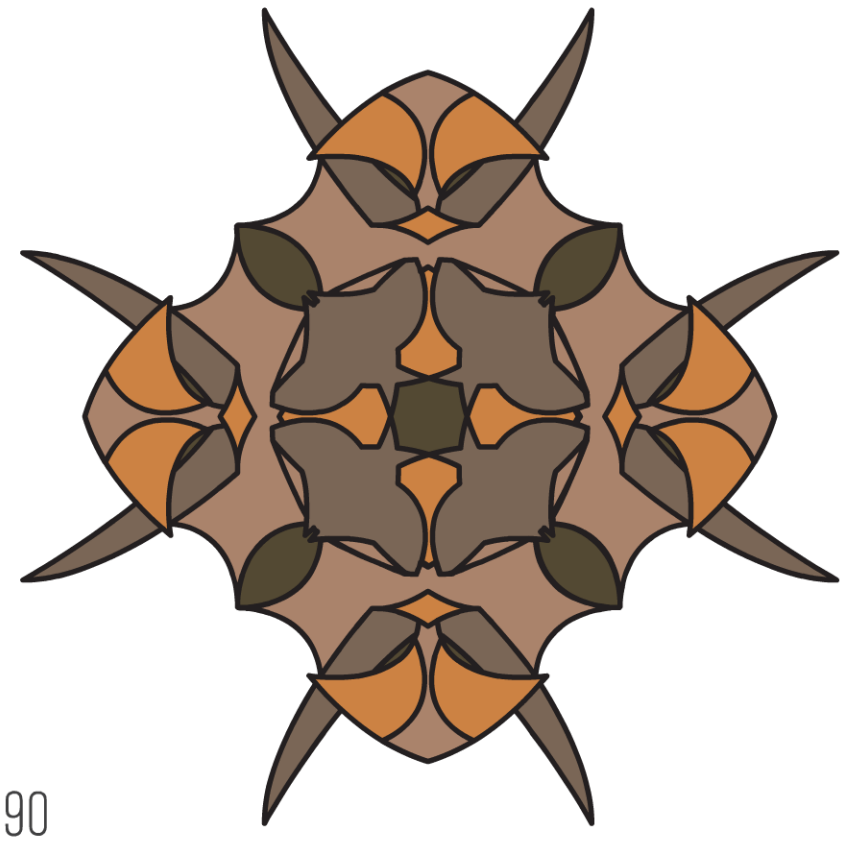
Owl Face



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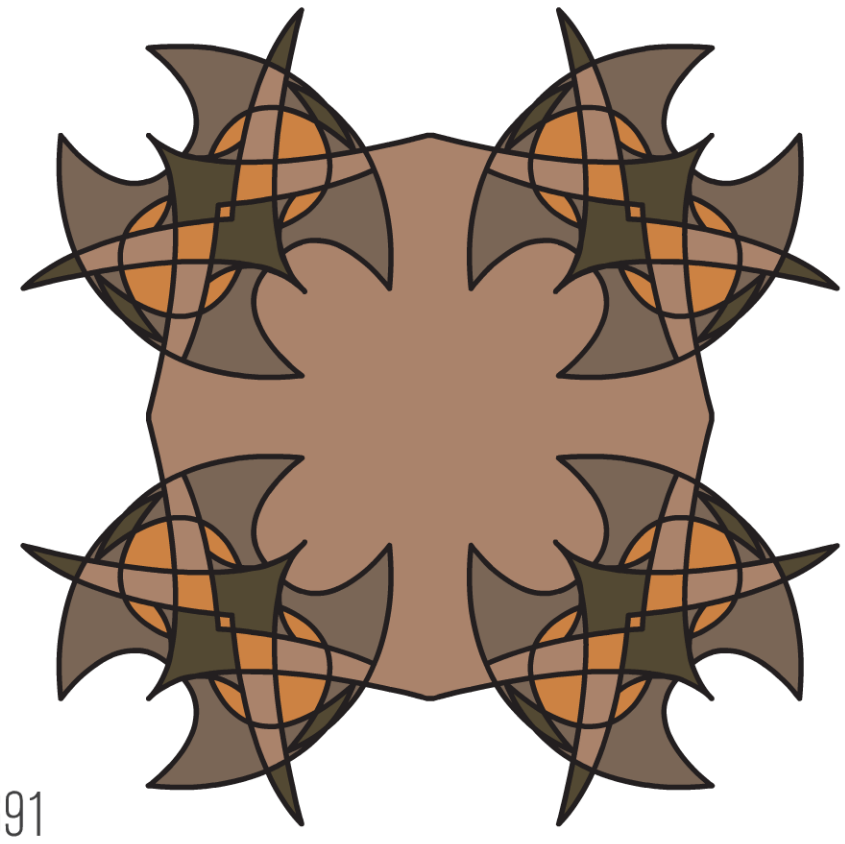

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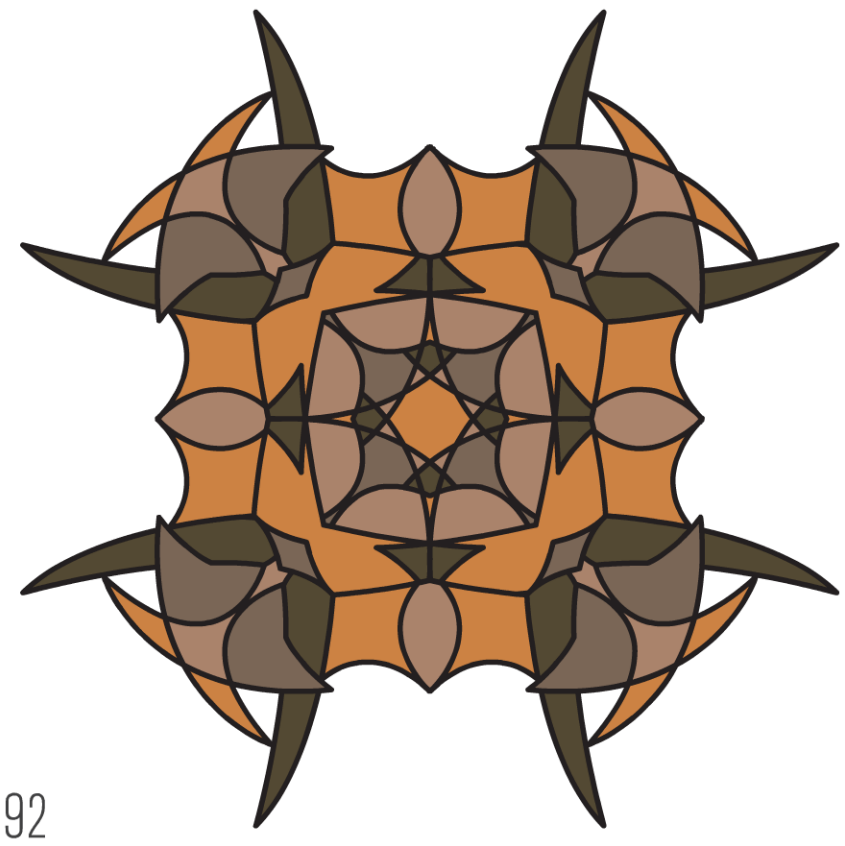

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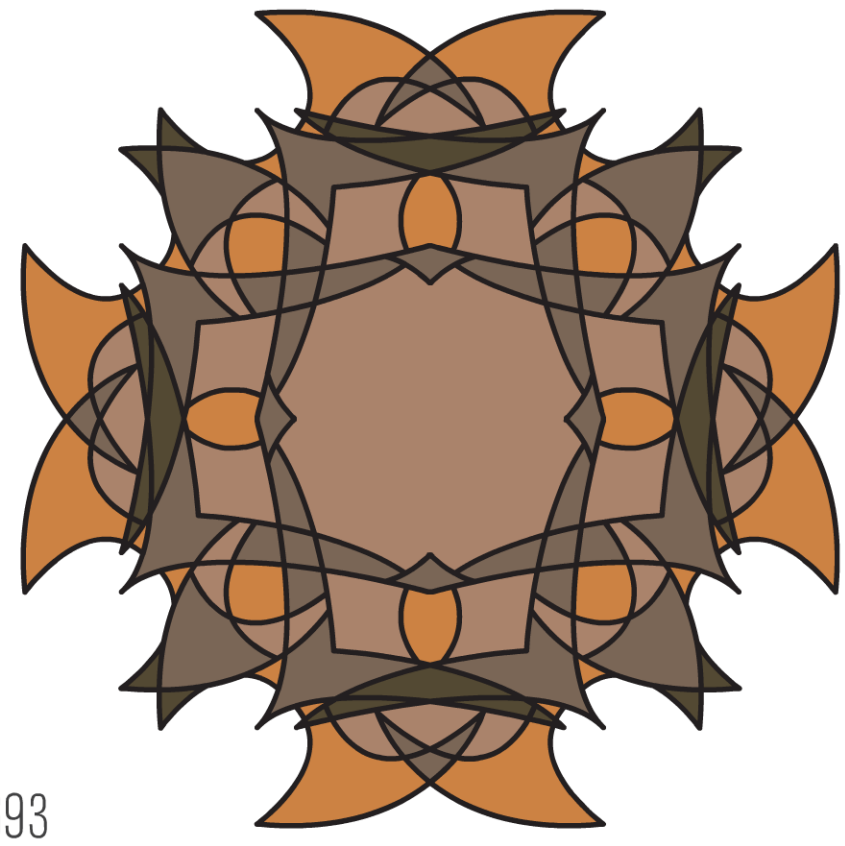

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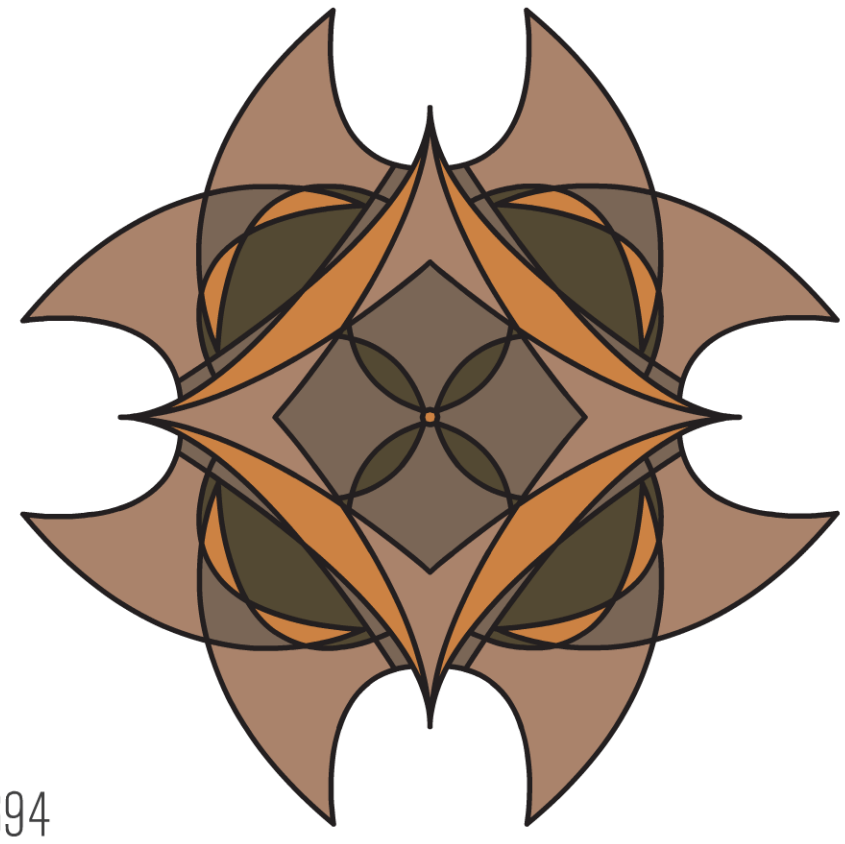

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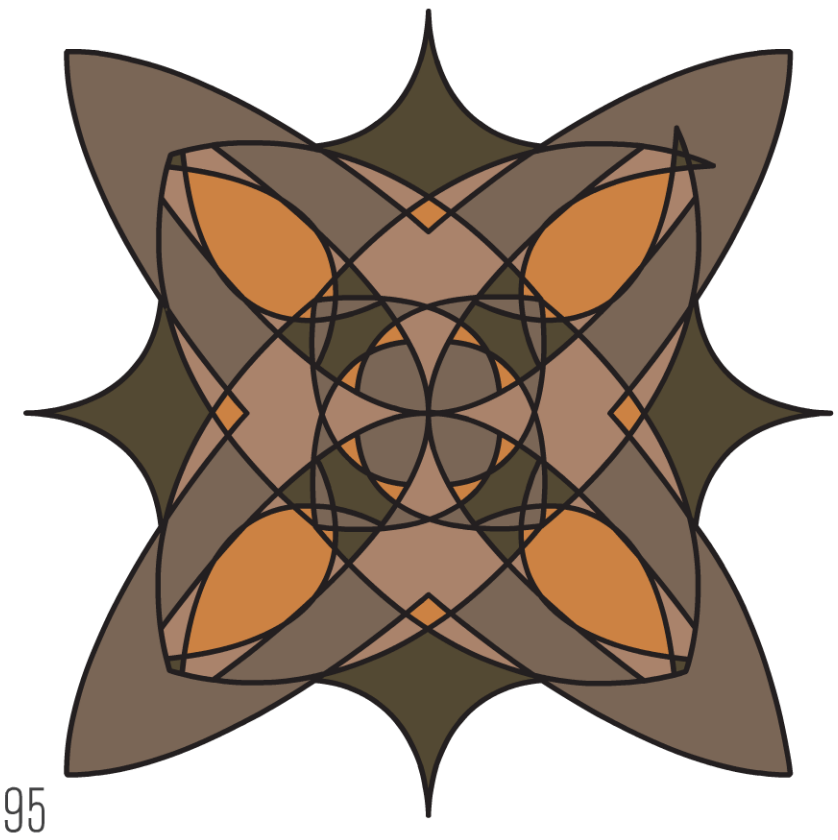

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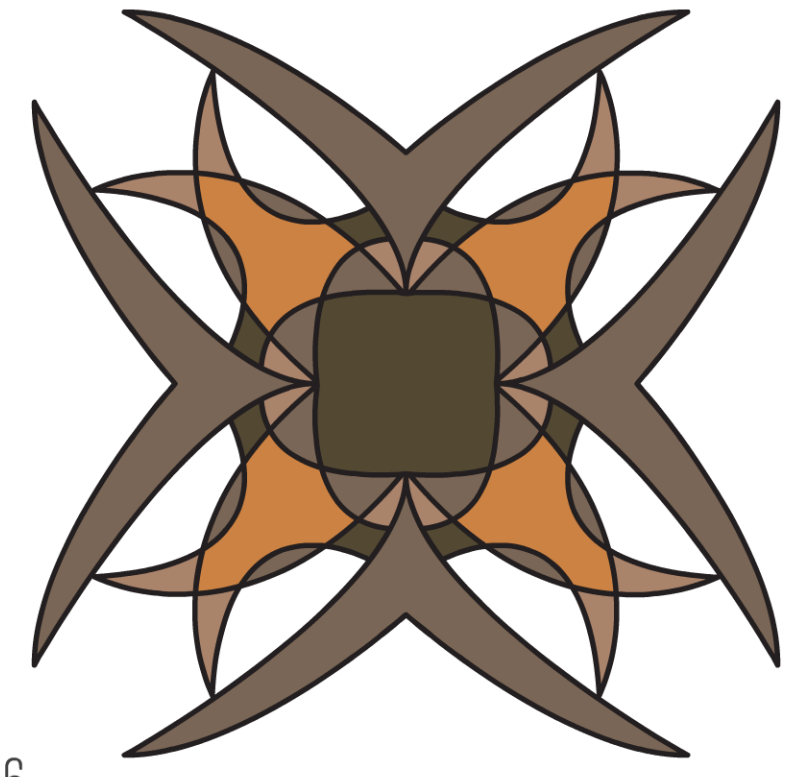

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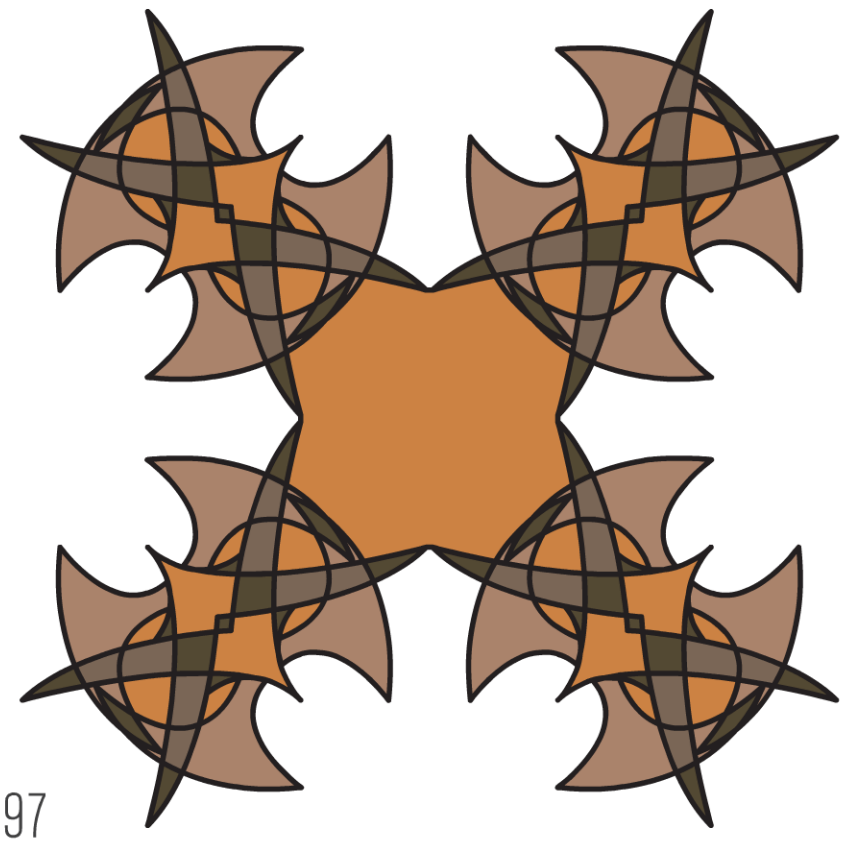

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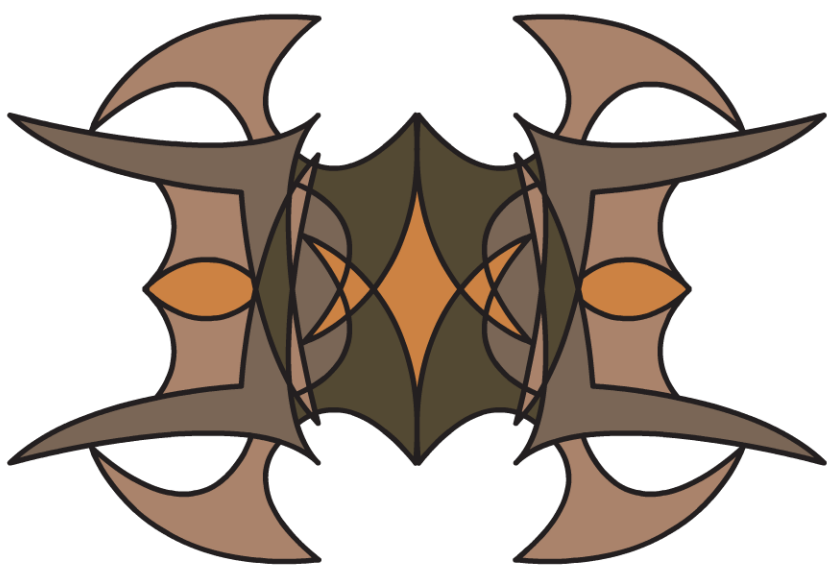

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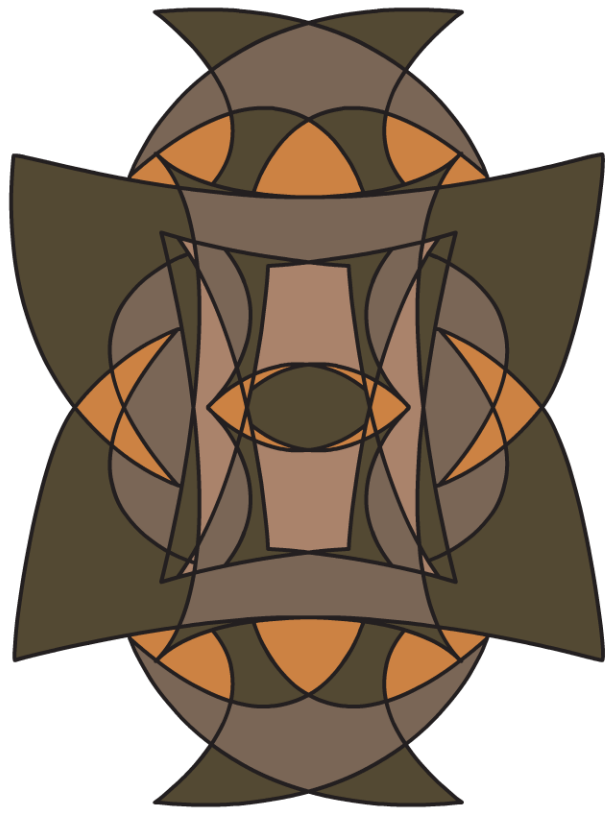

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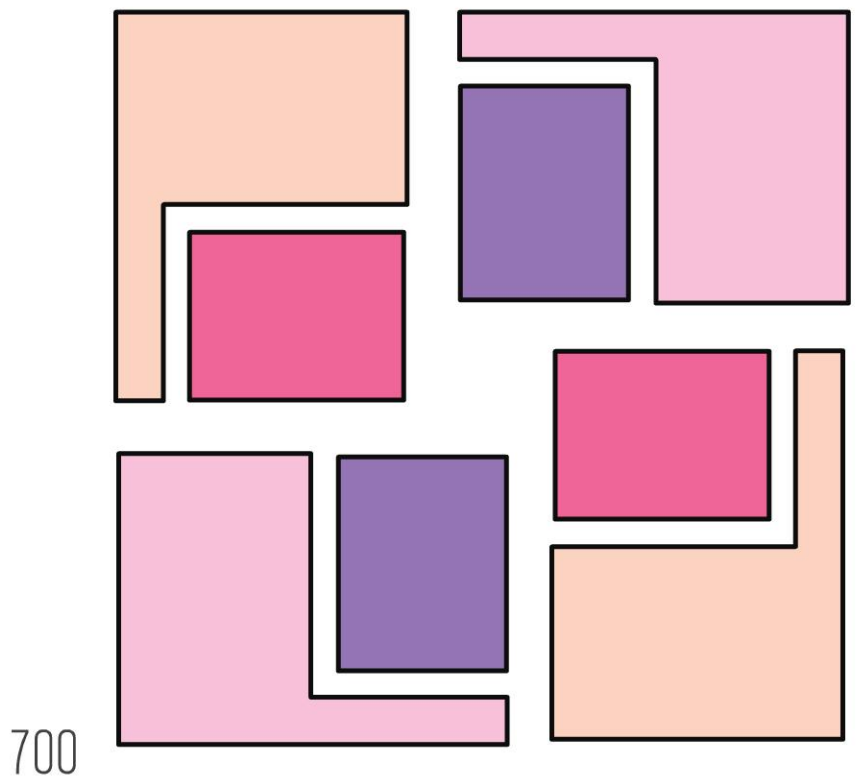

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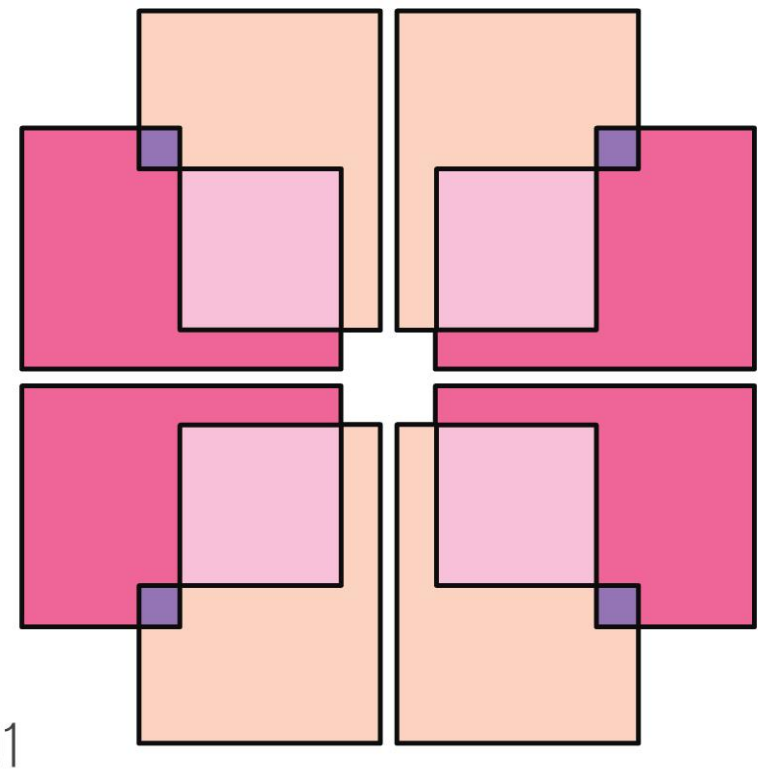

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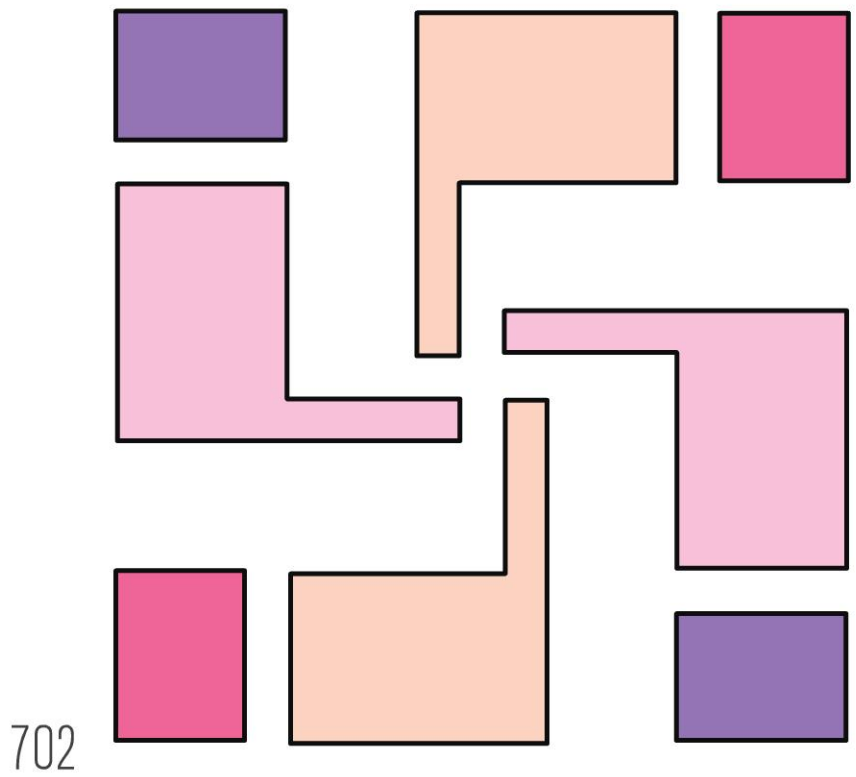

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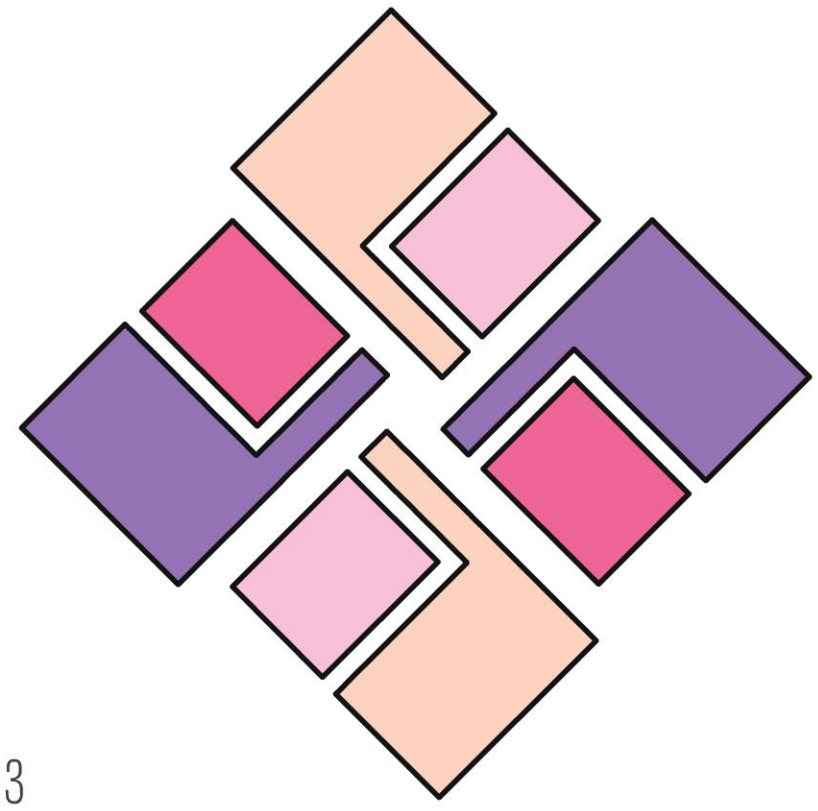

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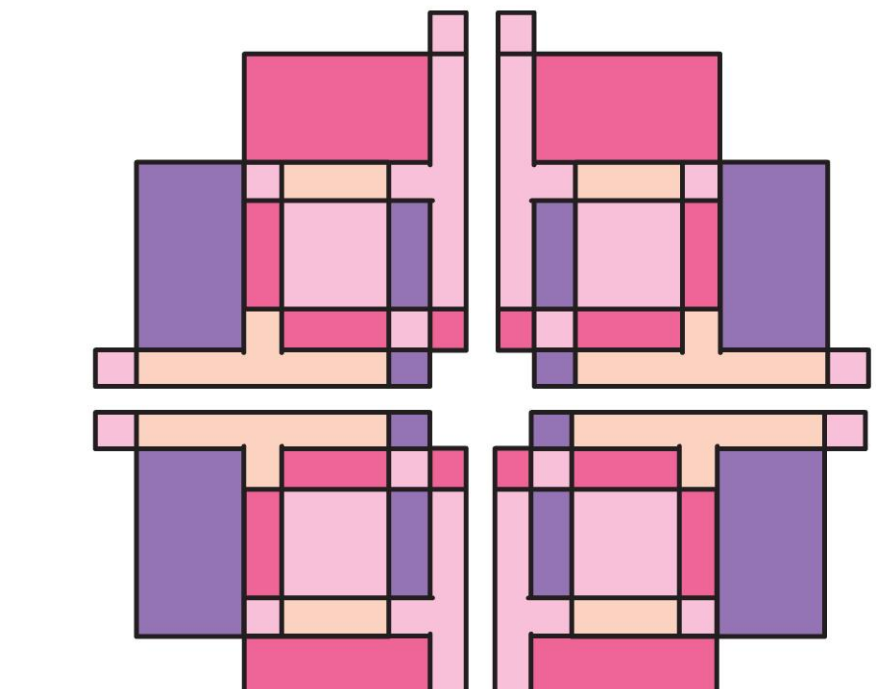

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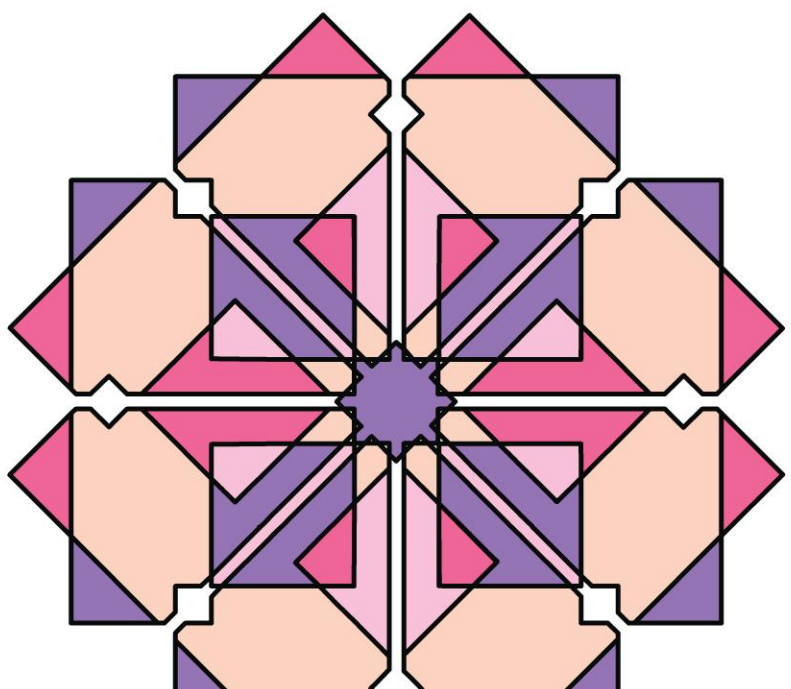

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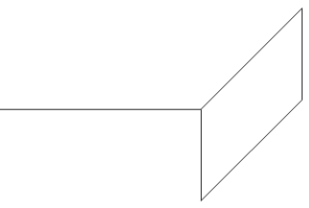

Parallelograms

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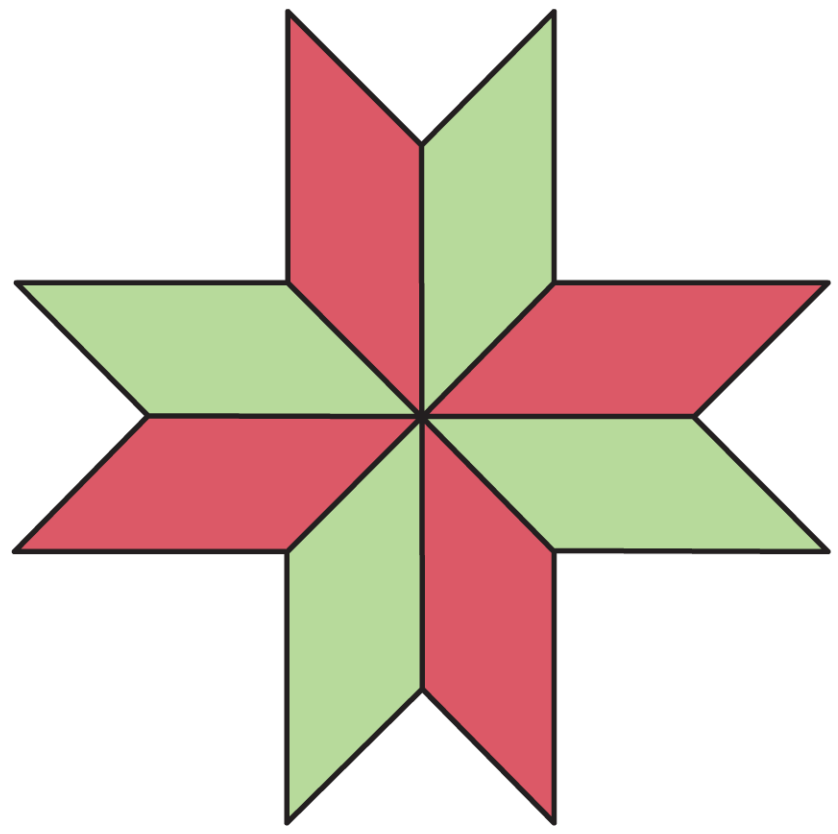

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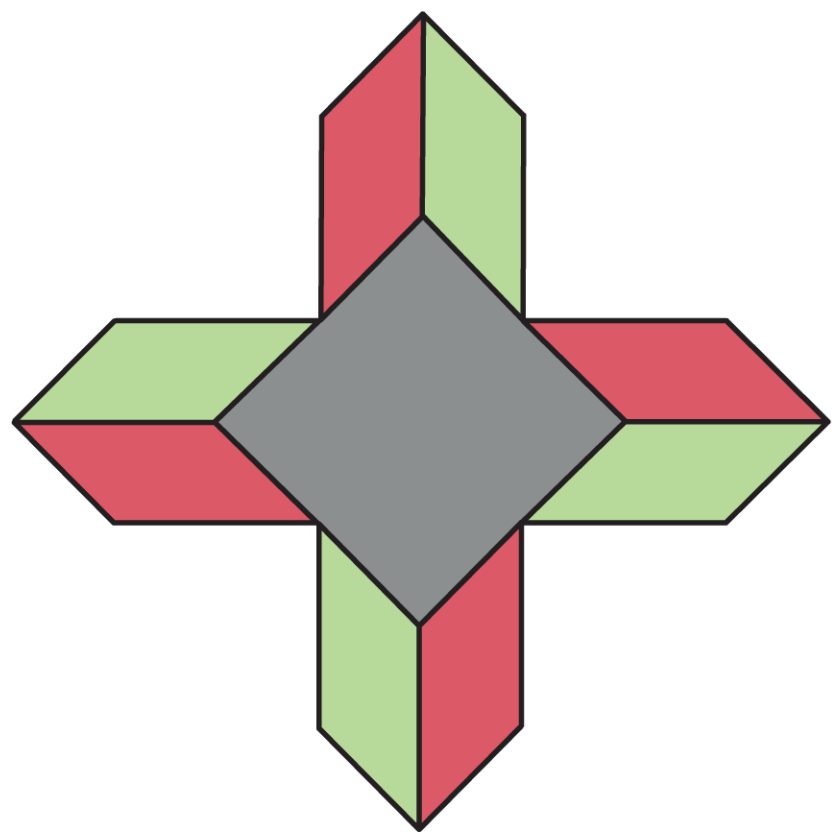

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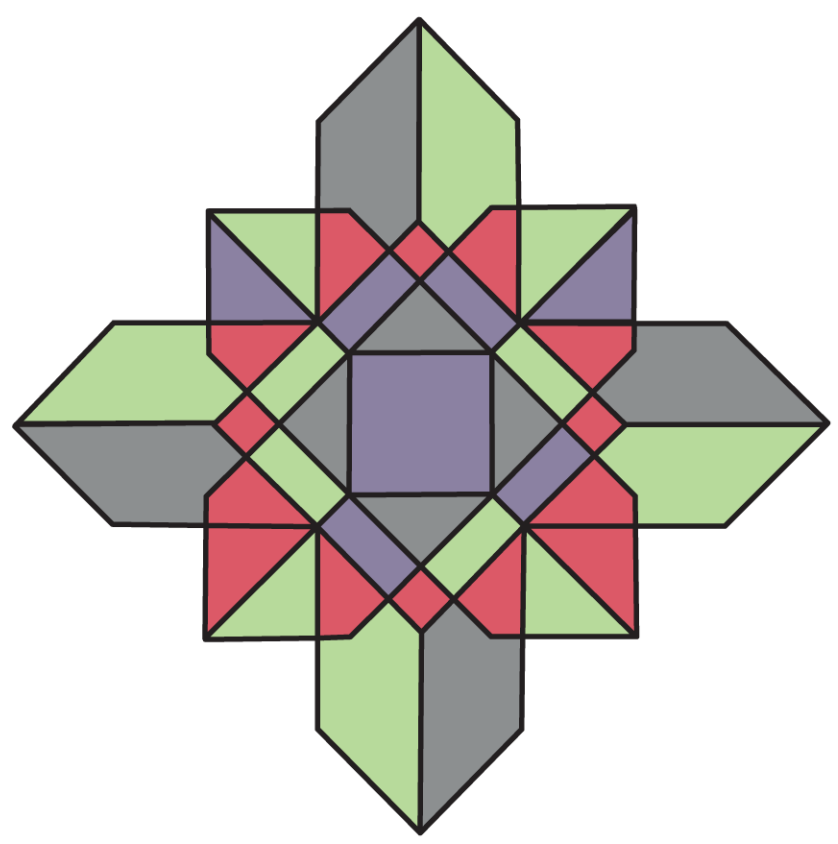

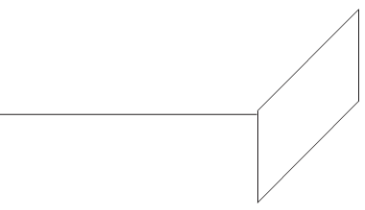

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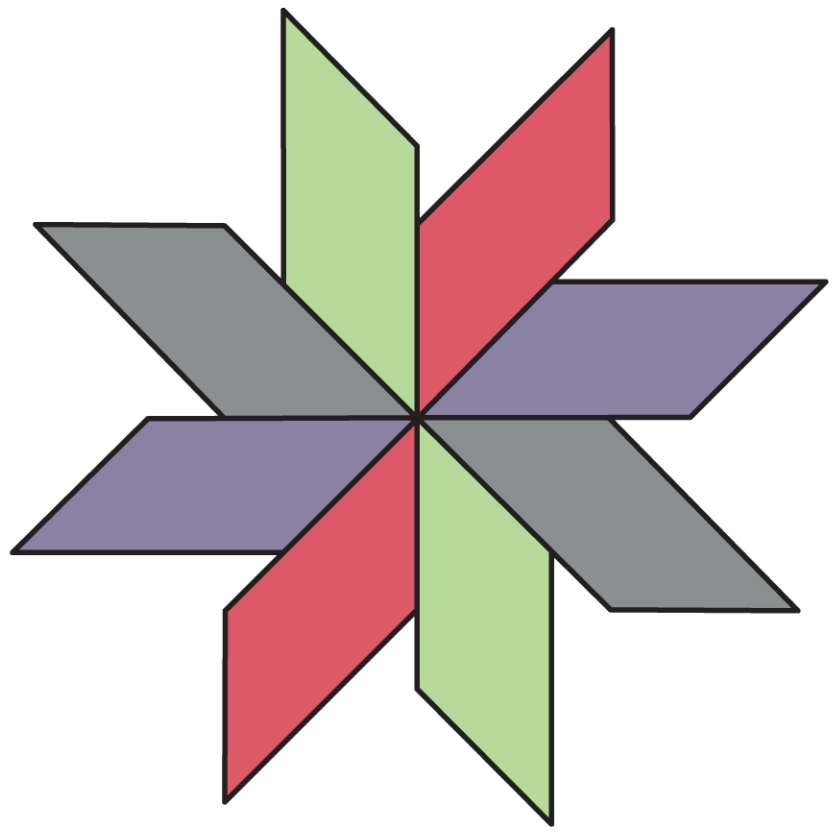

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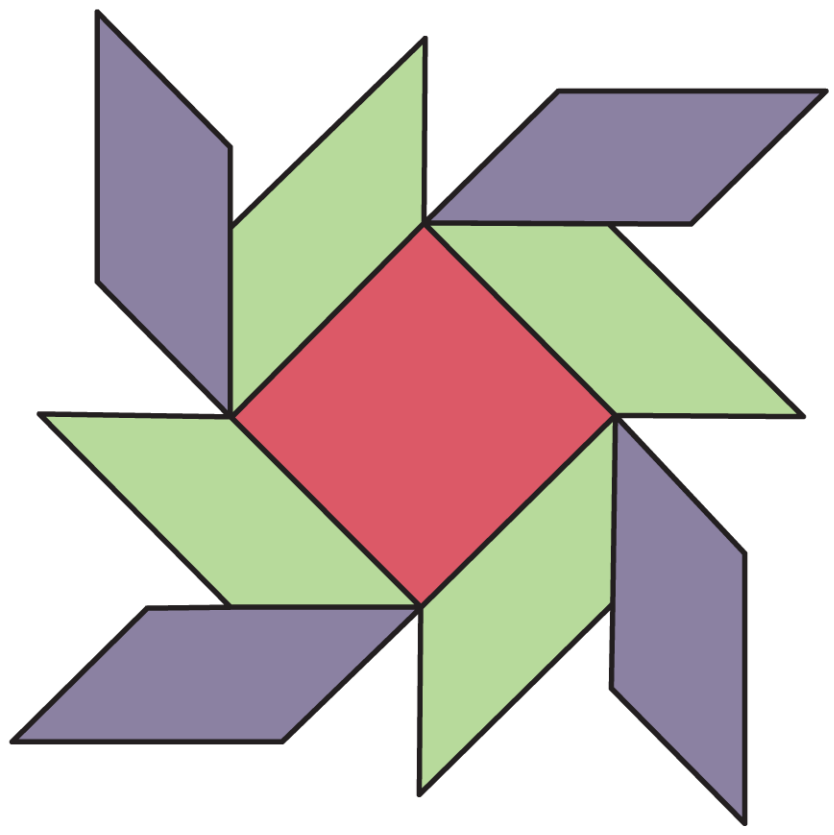

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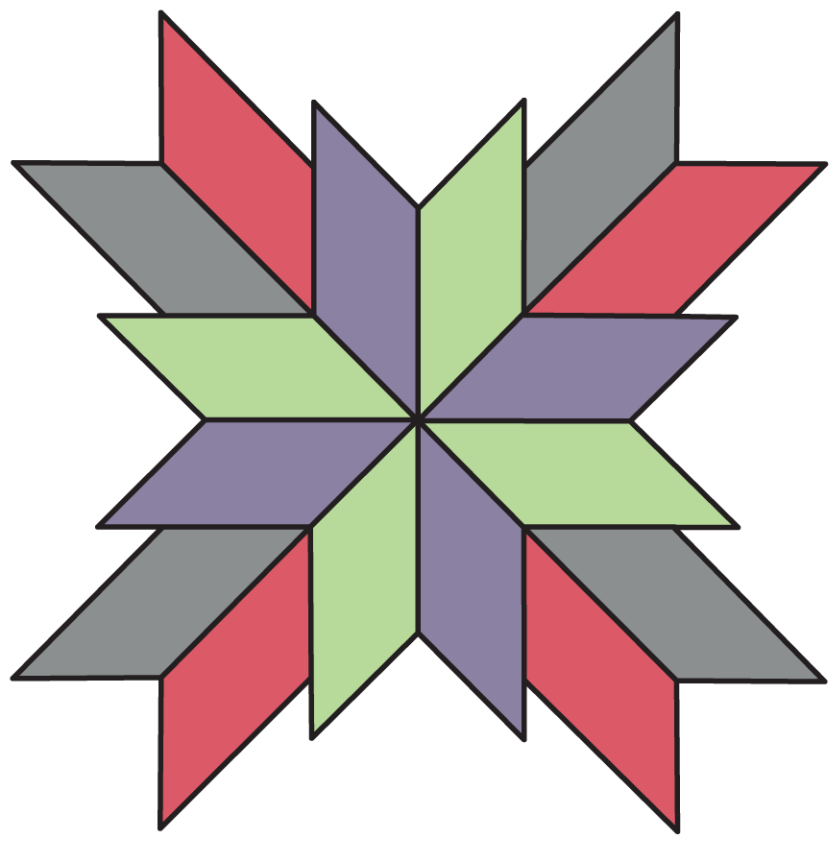

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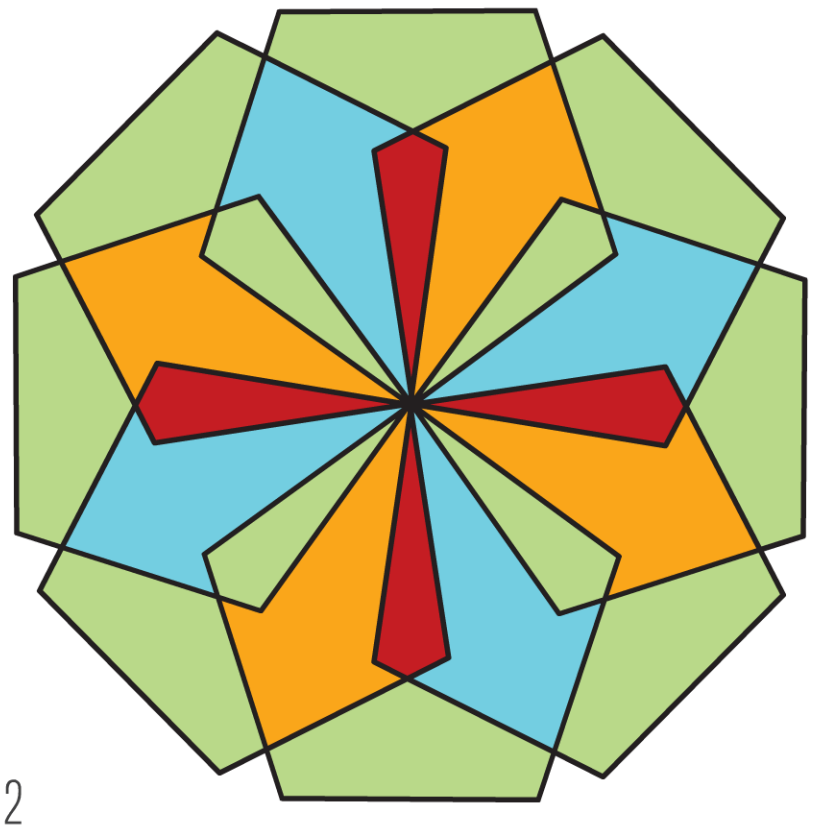
Pentagrams



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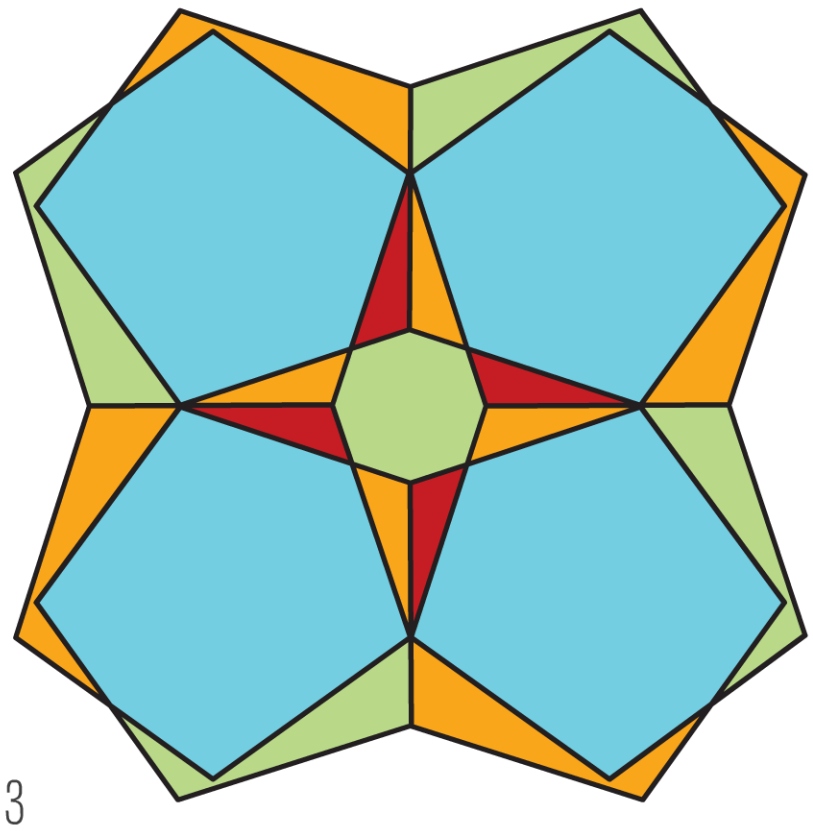

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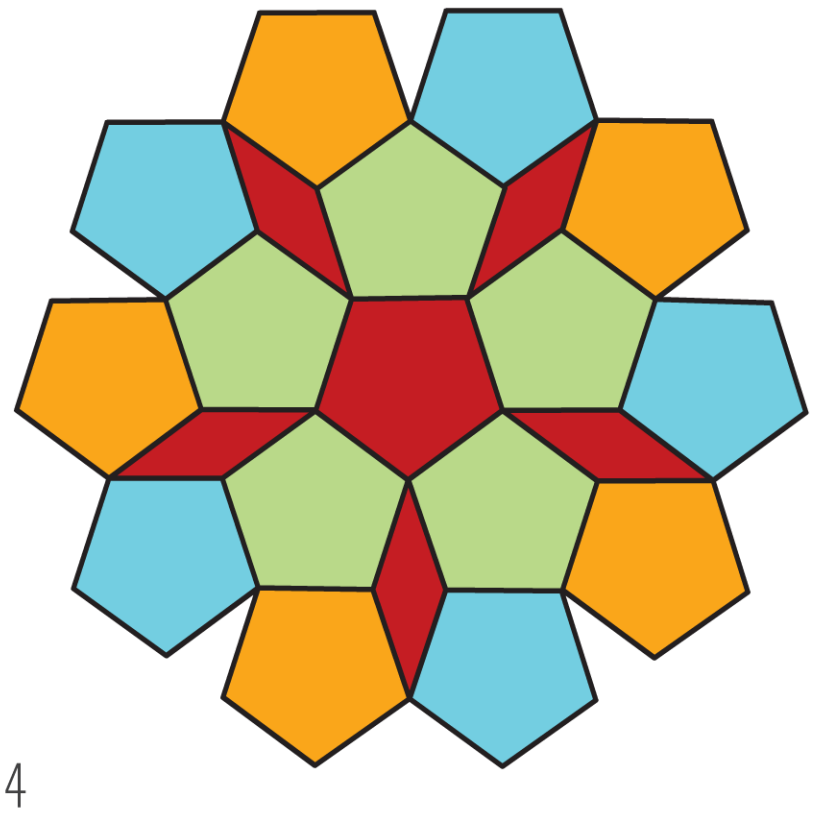

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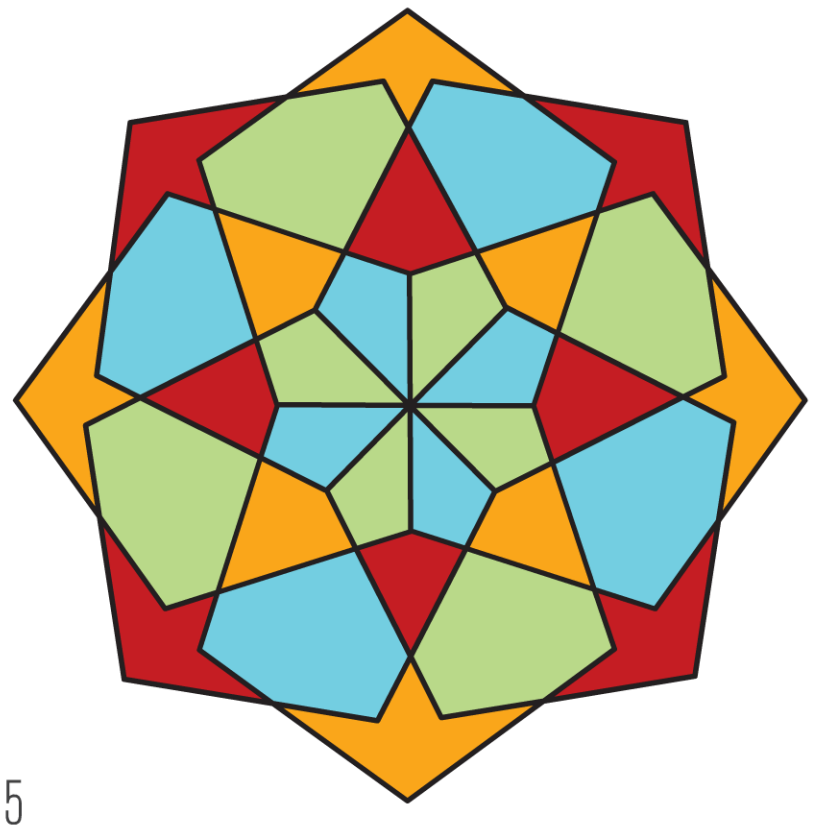

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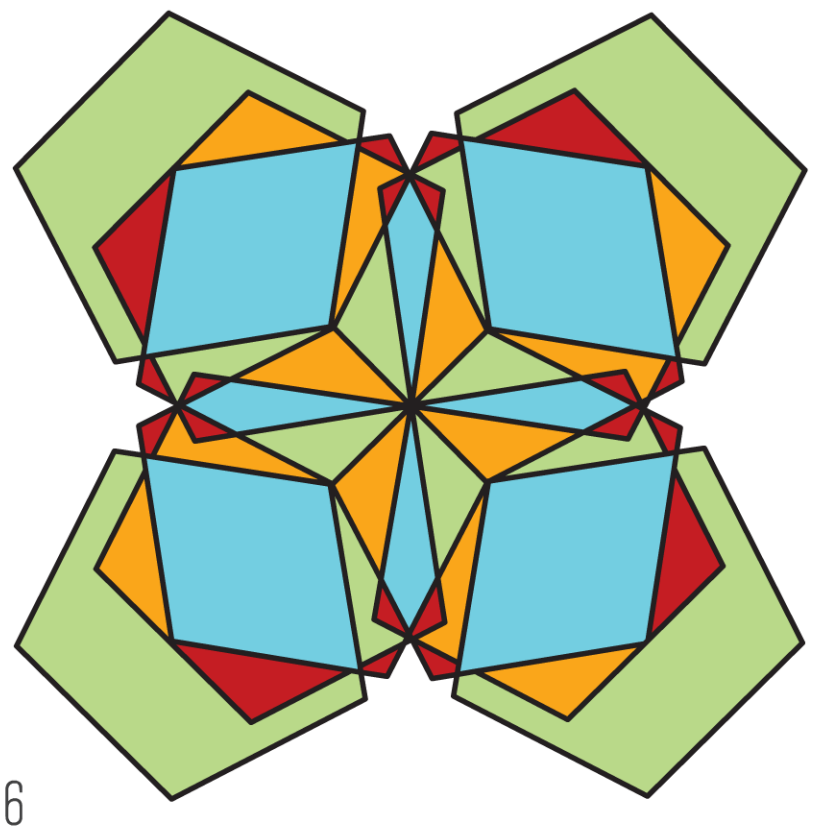

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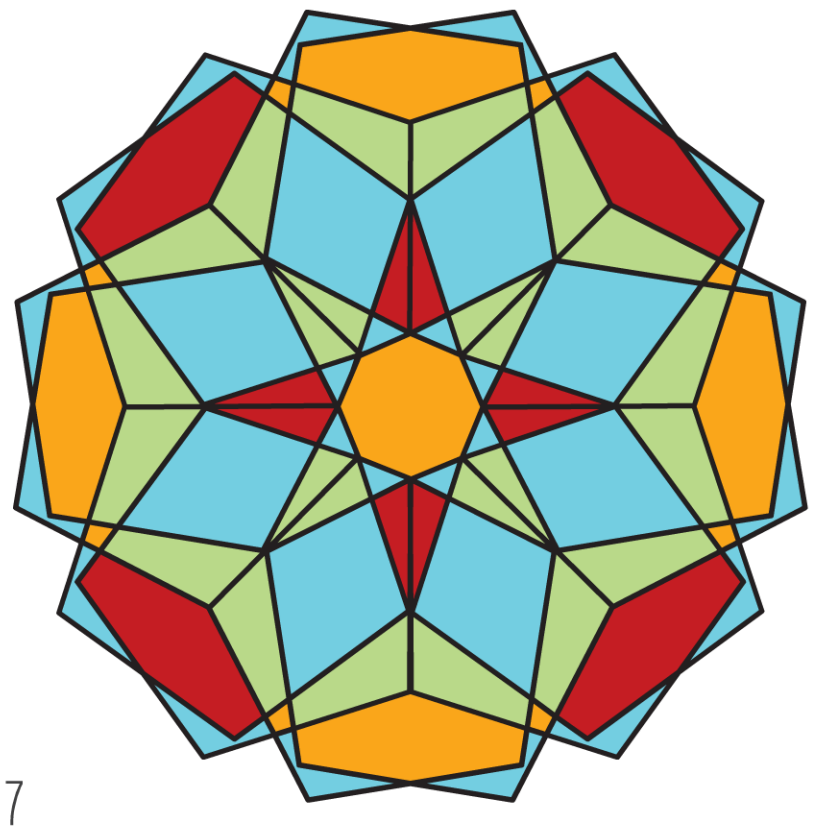

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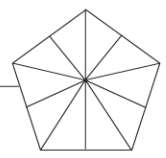
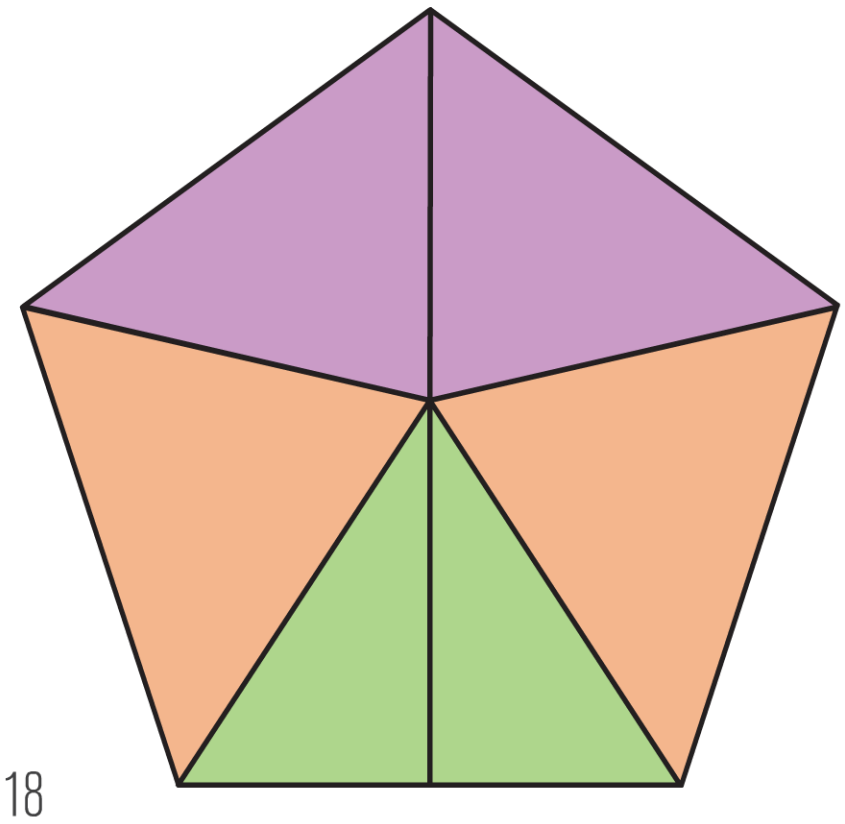


Pentagons Divided



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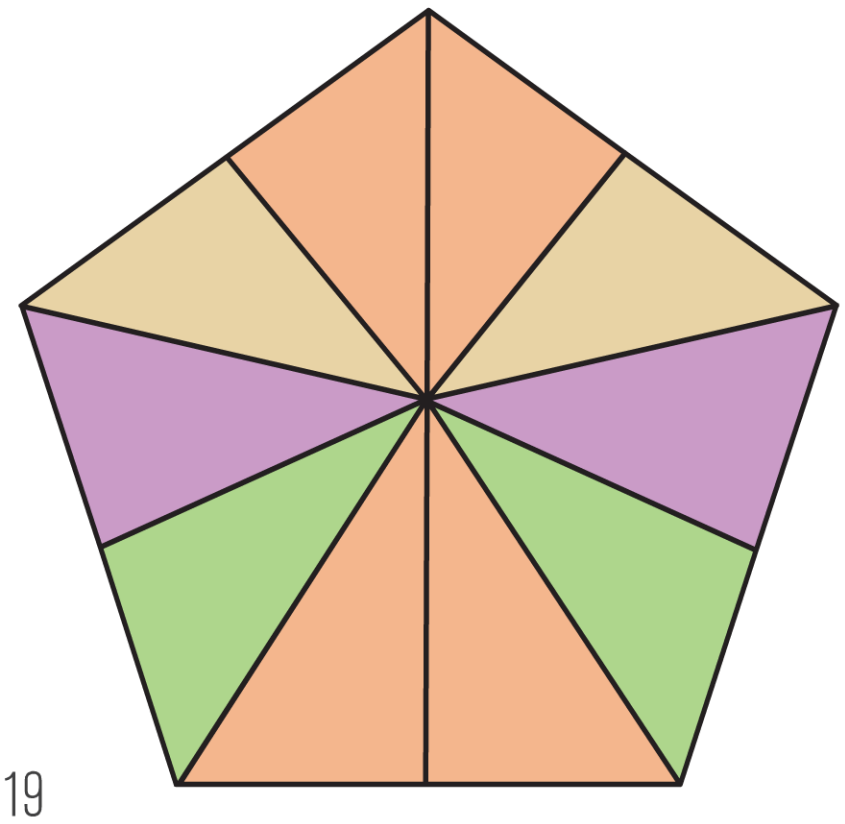

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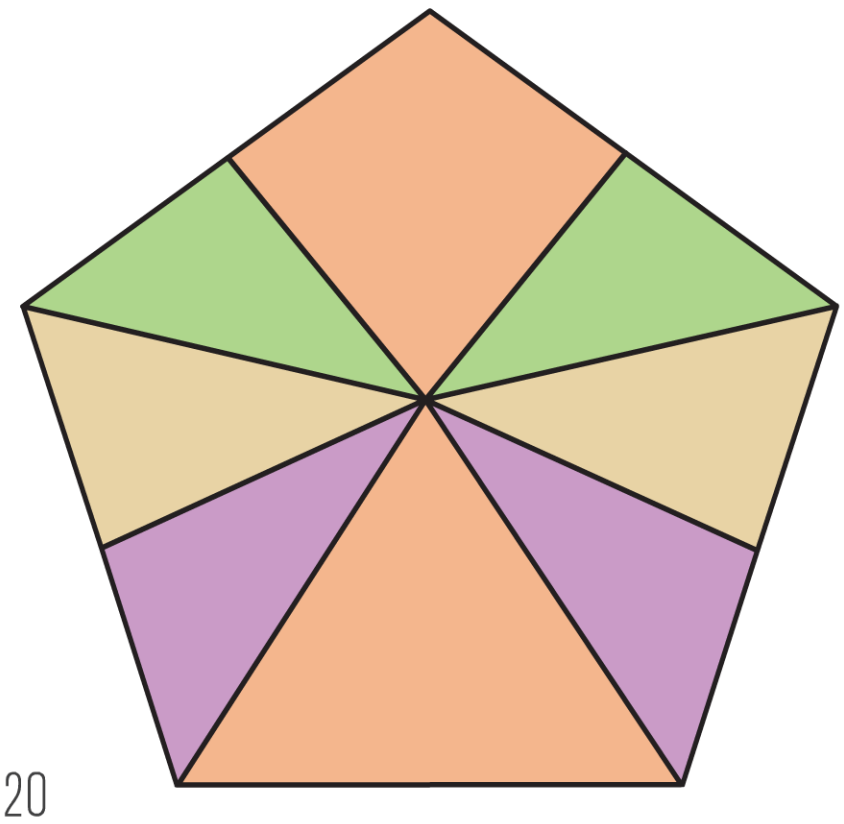

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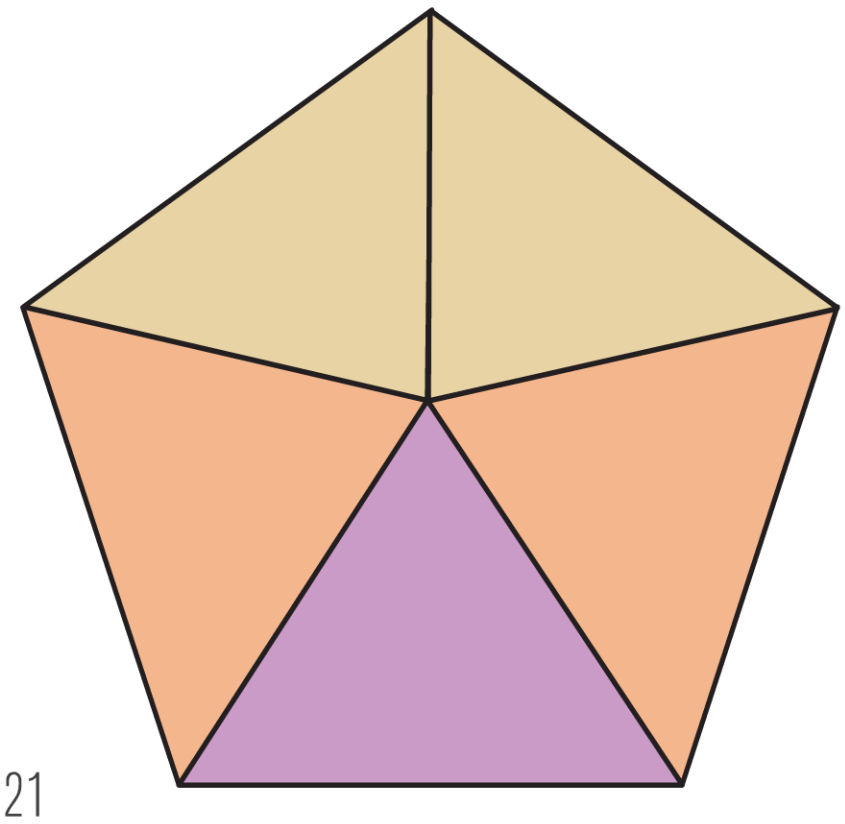

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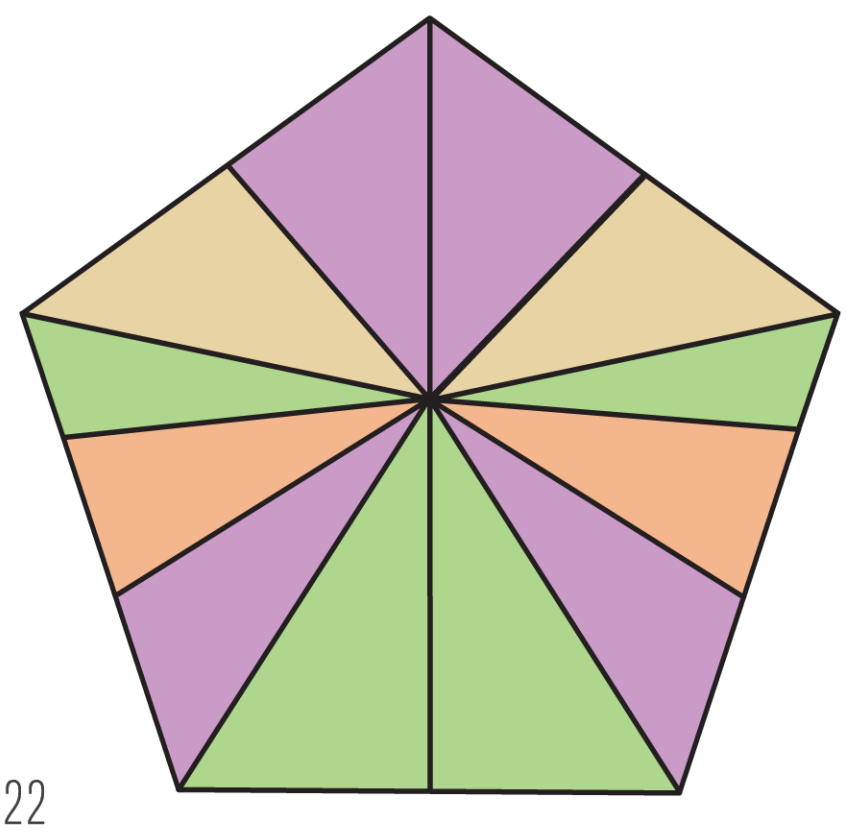

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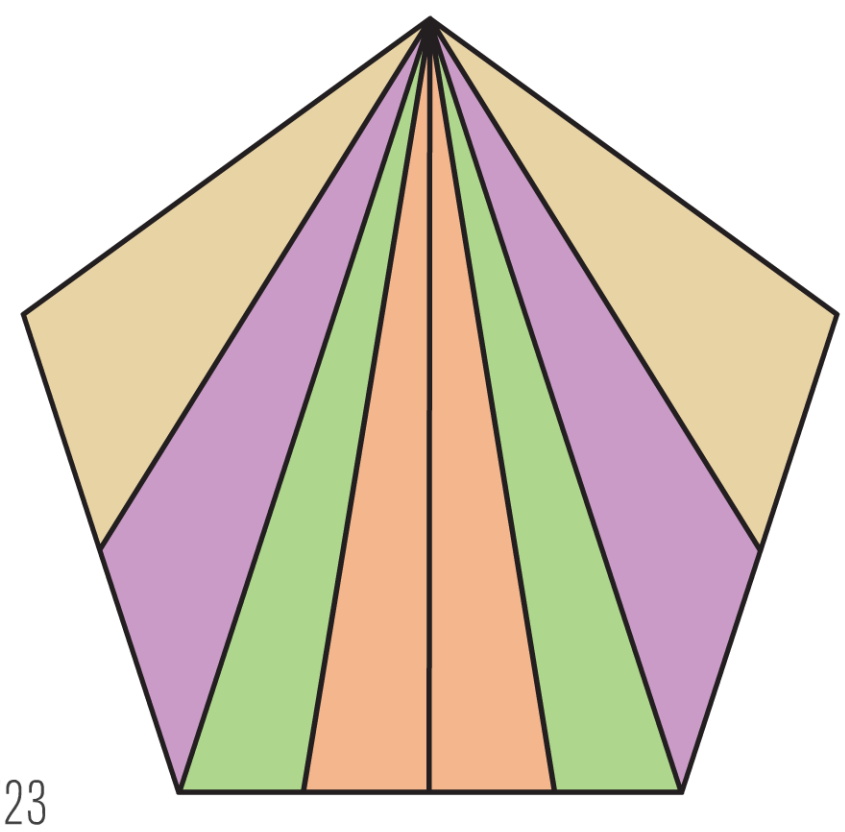

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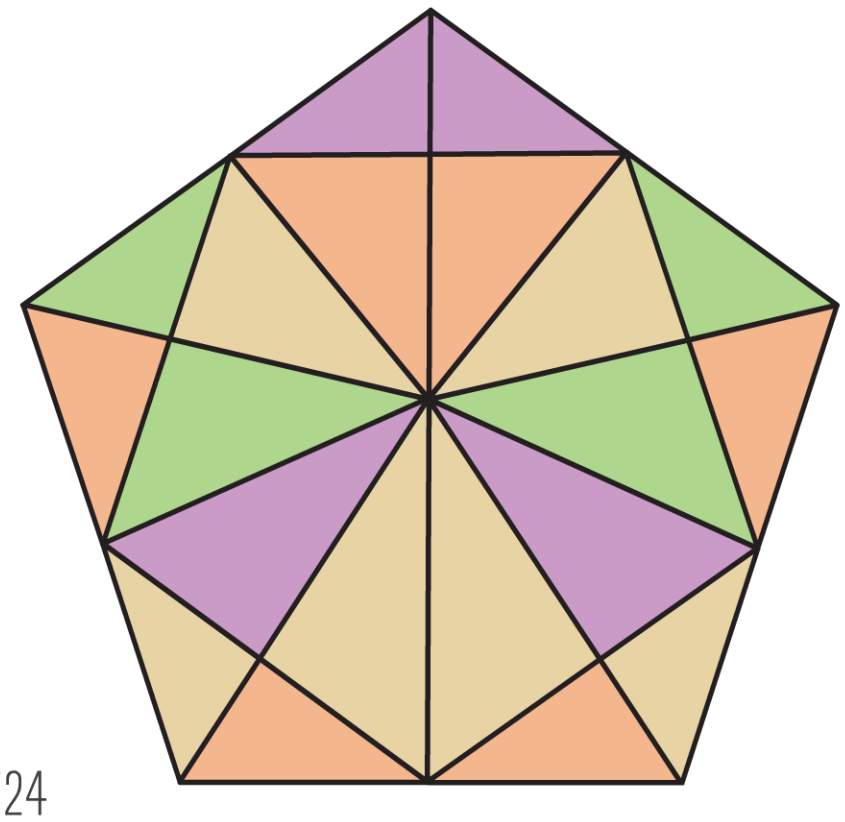

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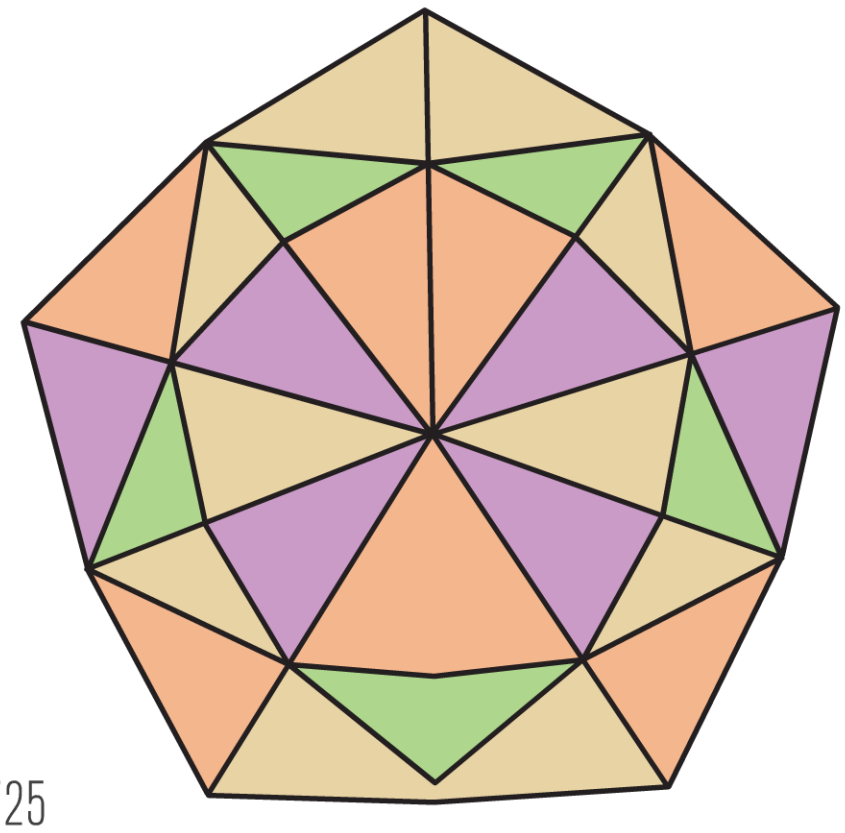

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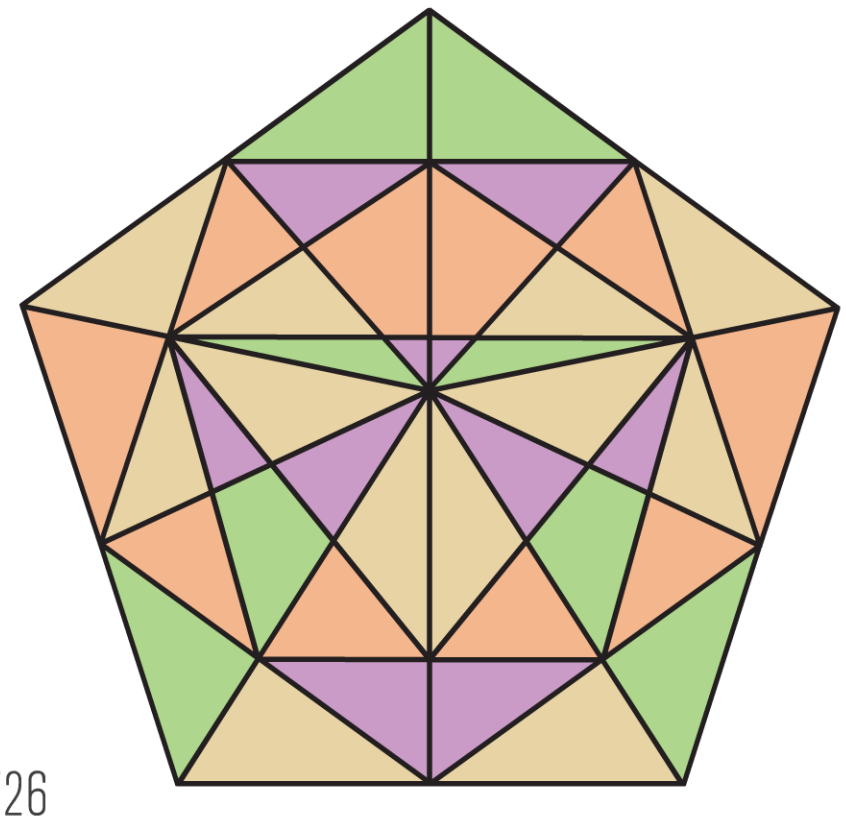

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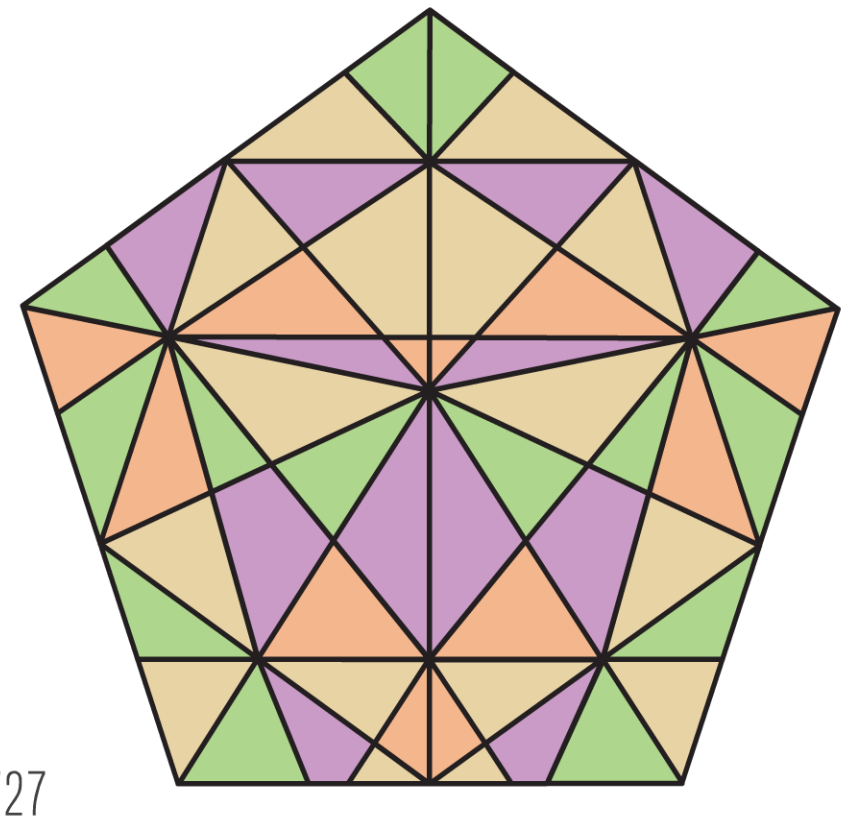

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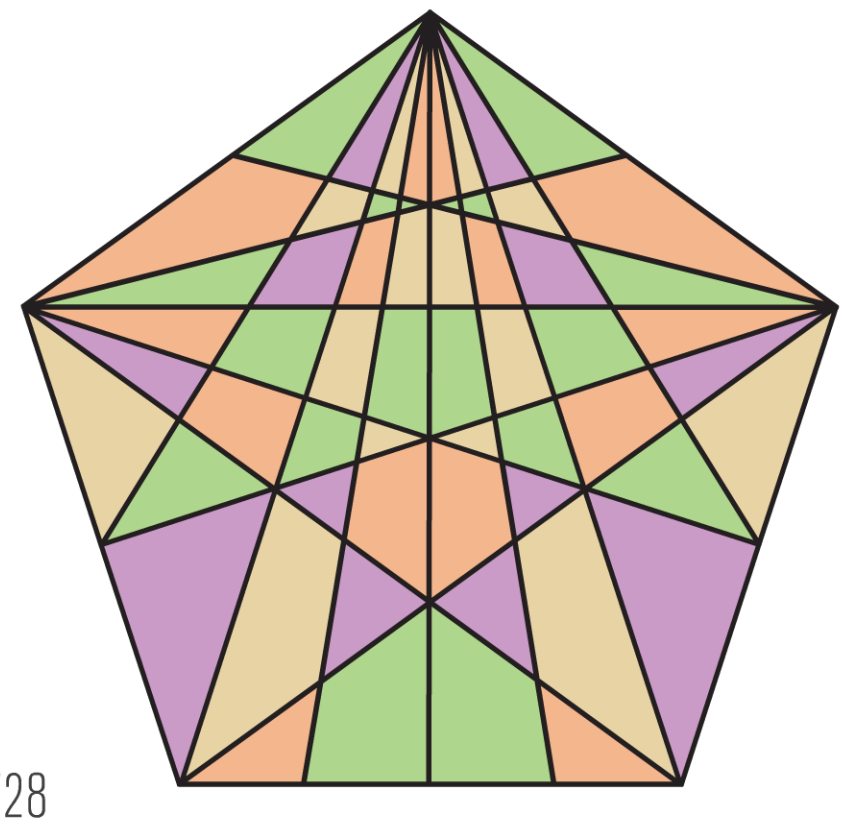

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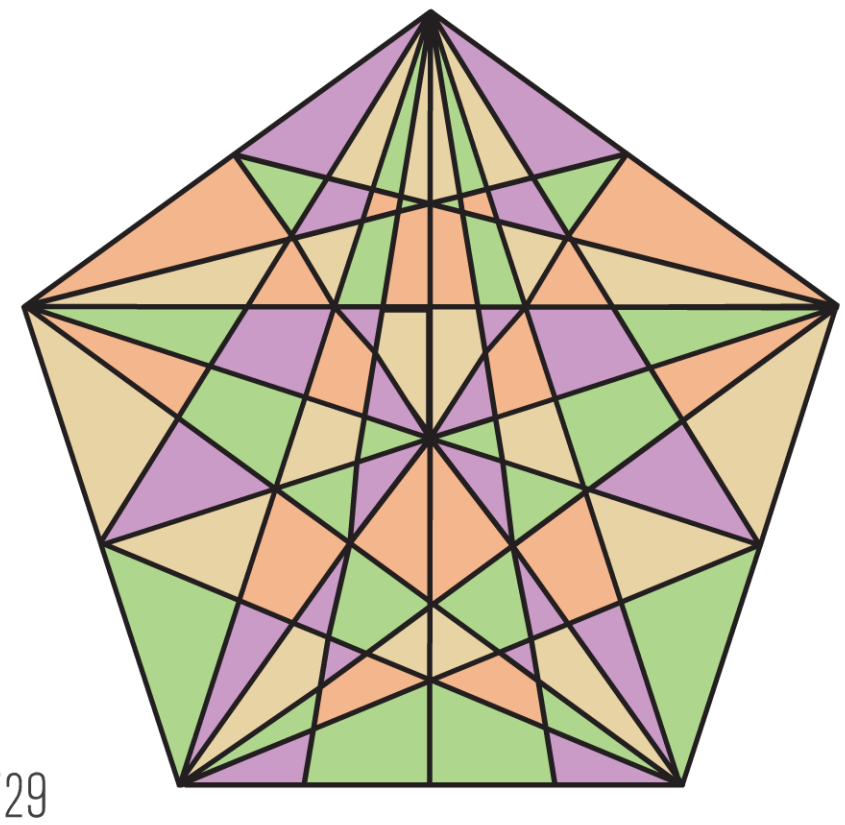

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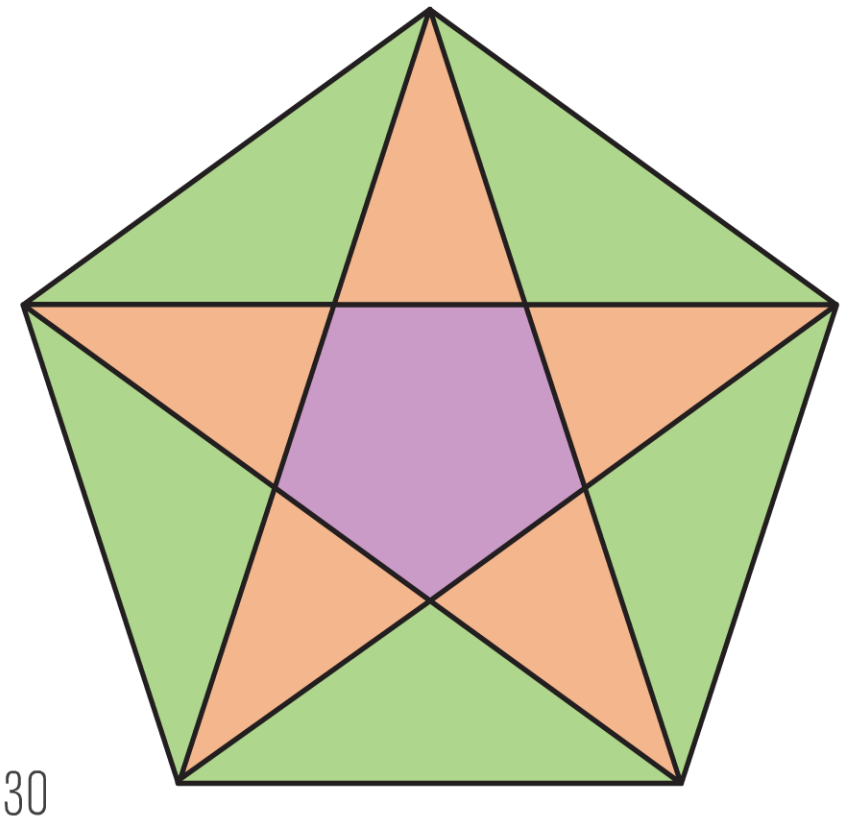

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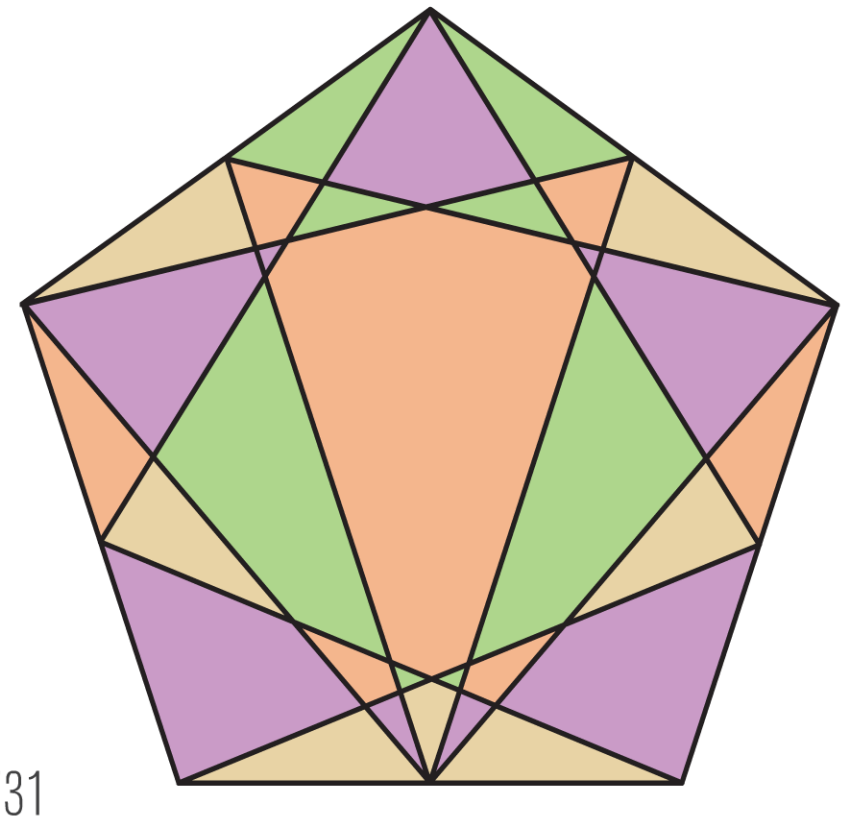

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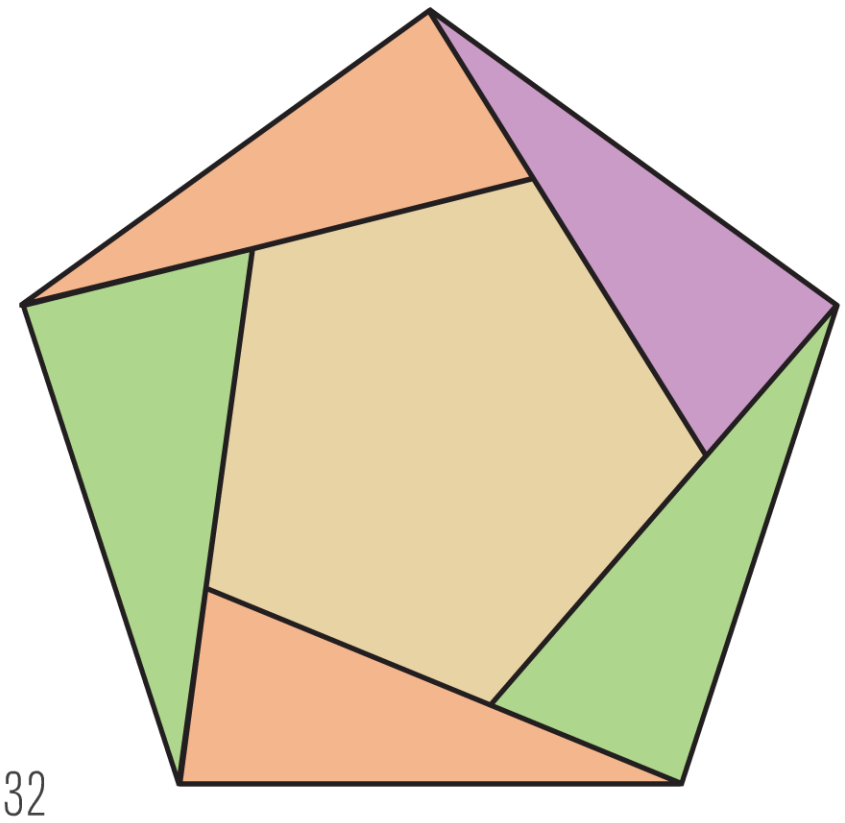

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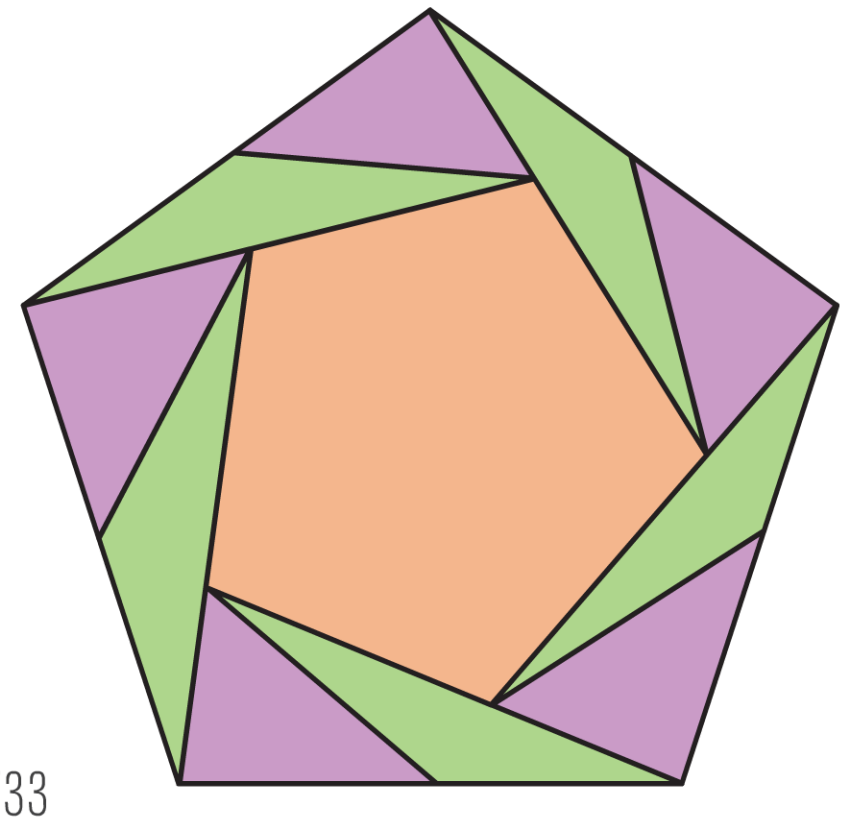

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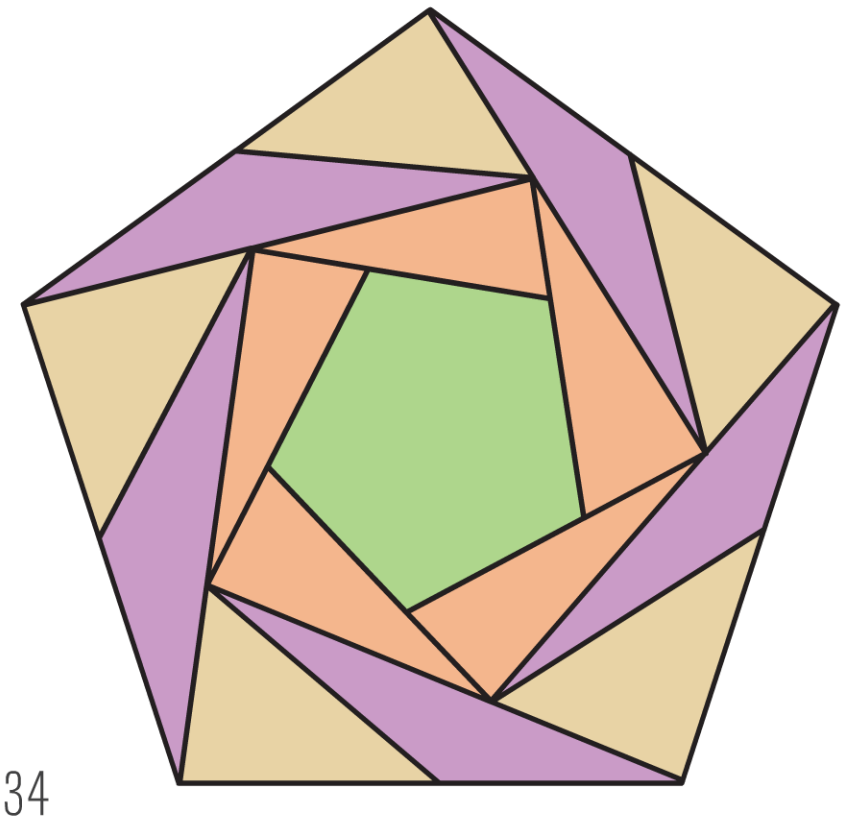

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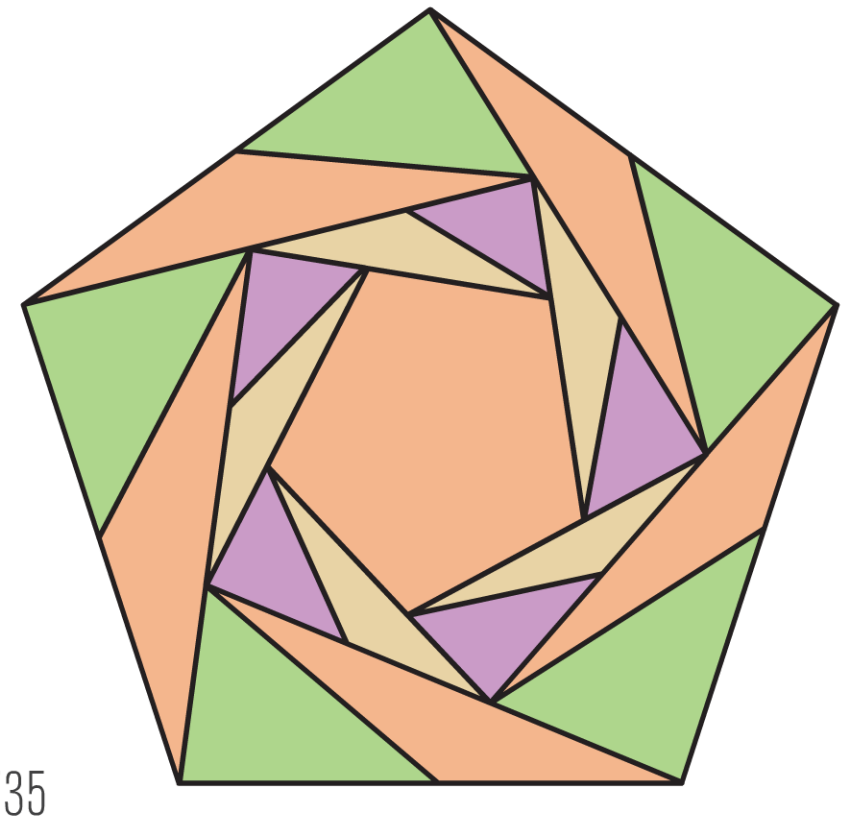

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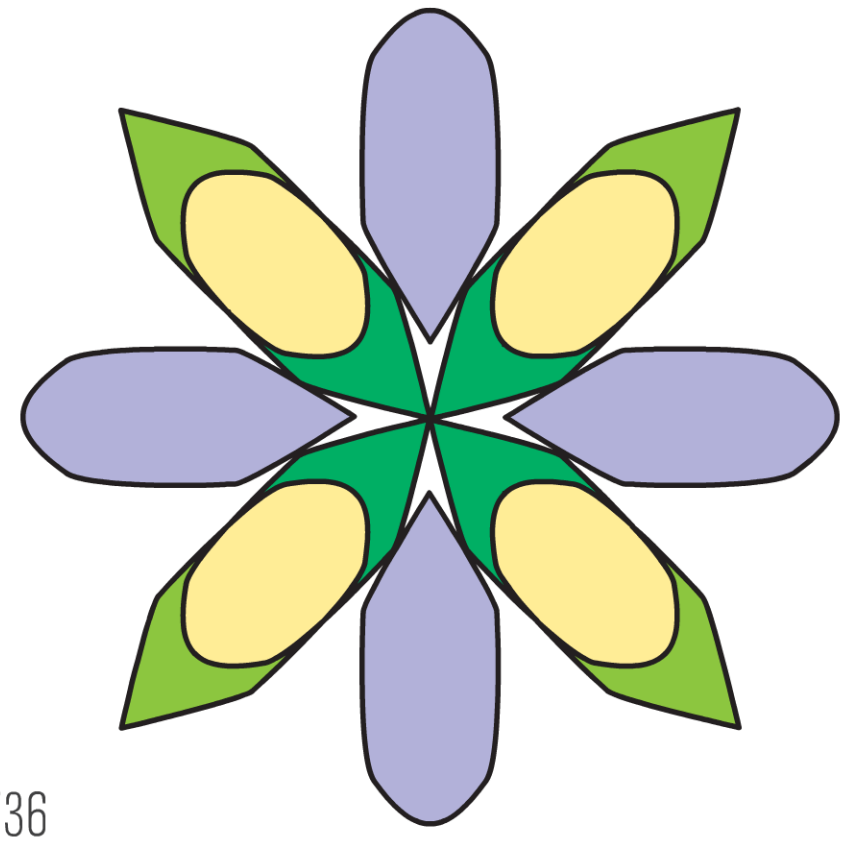
Petals



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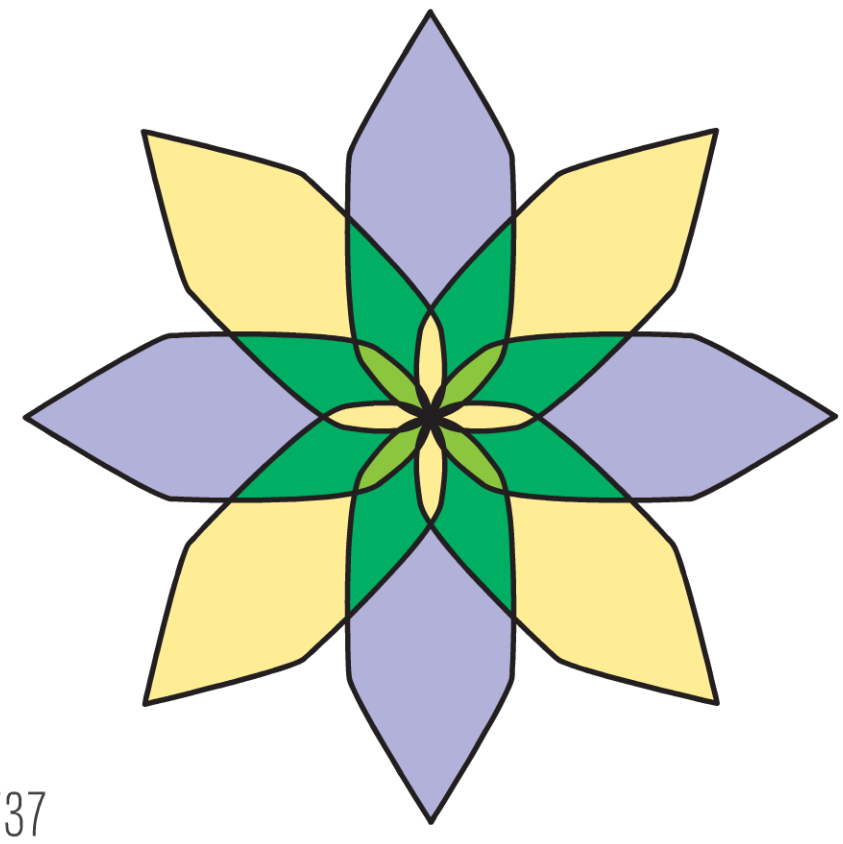

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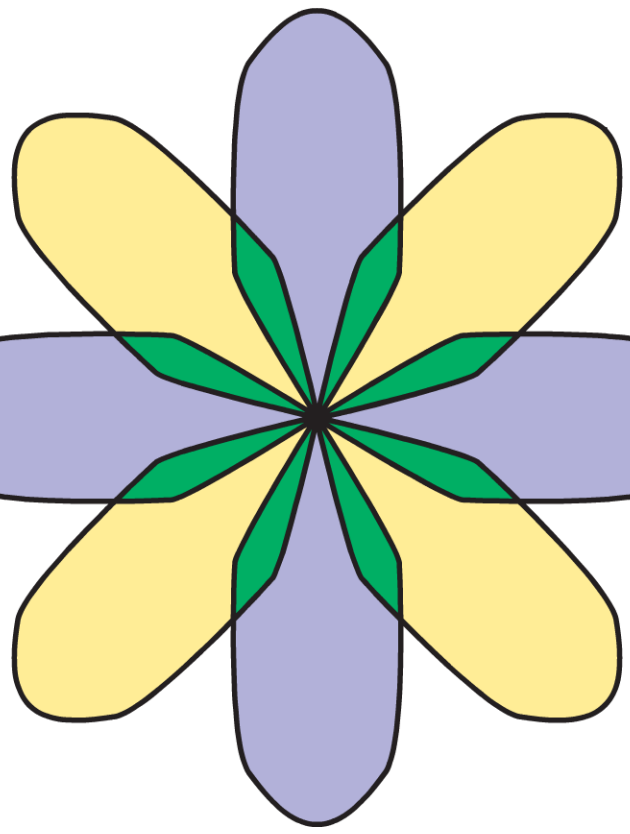

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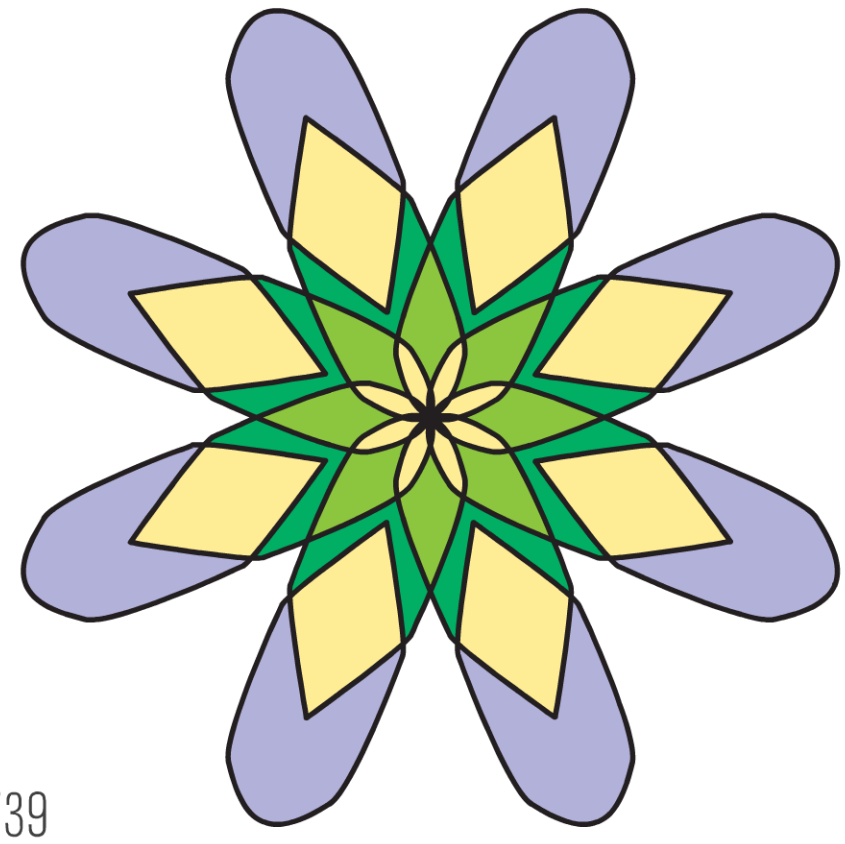

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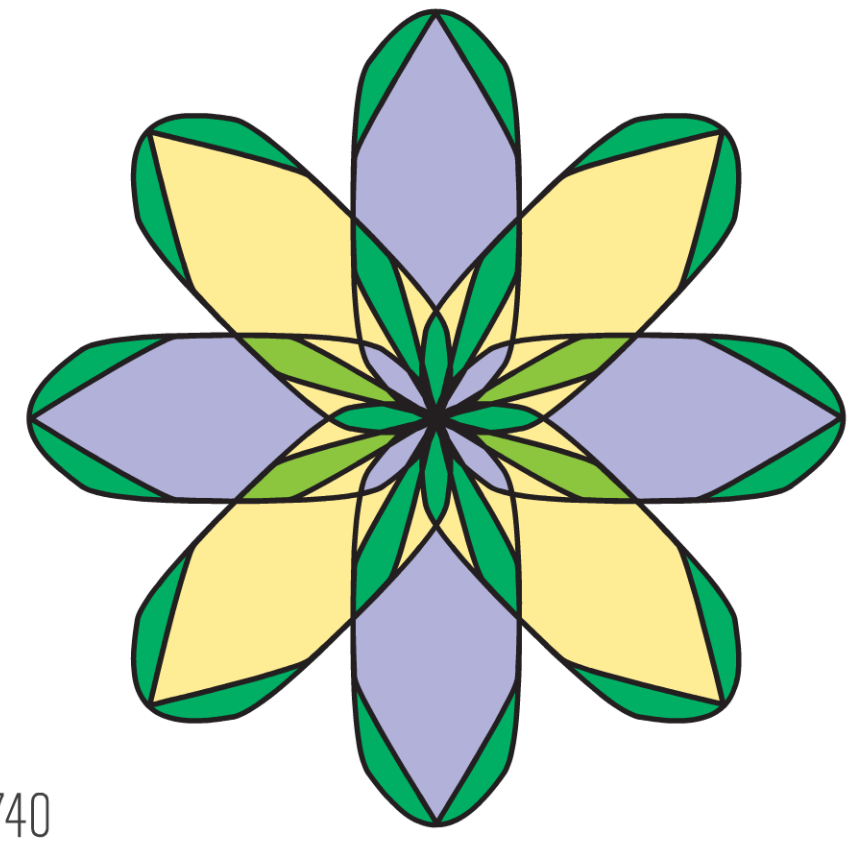

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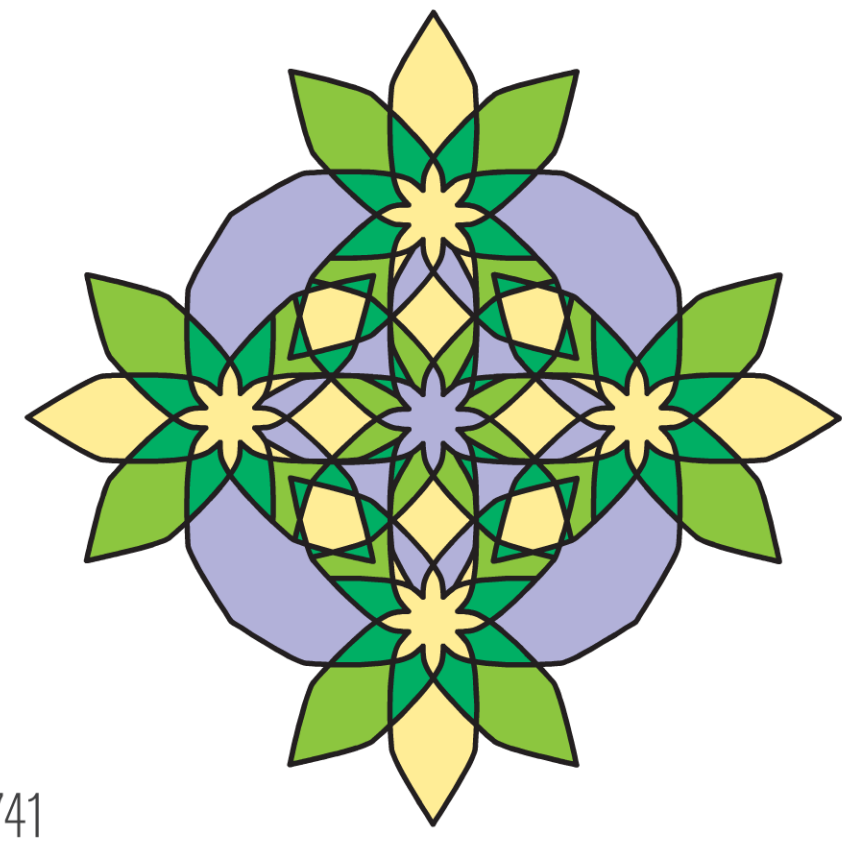

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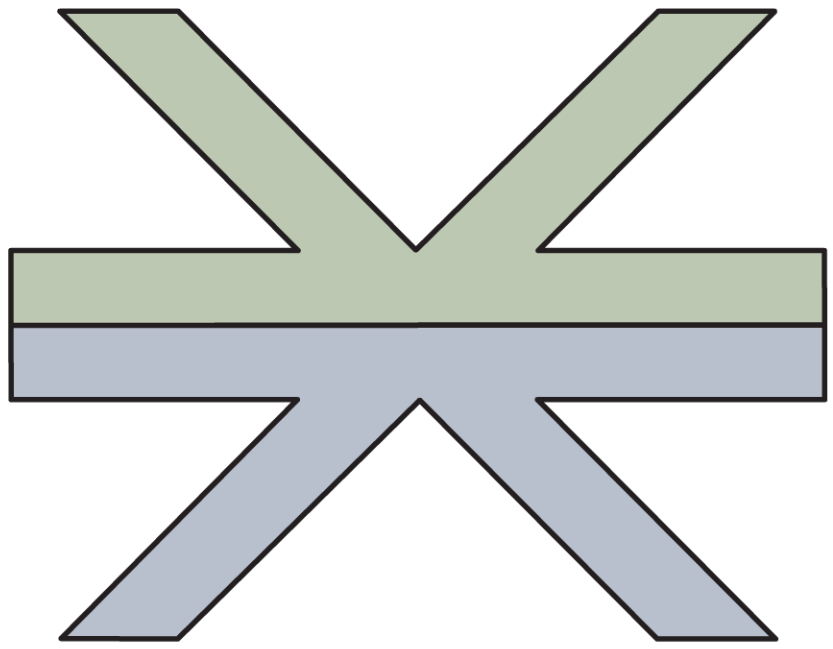
Picnic Tables



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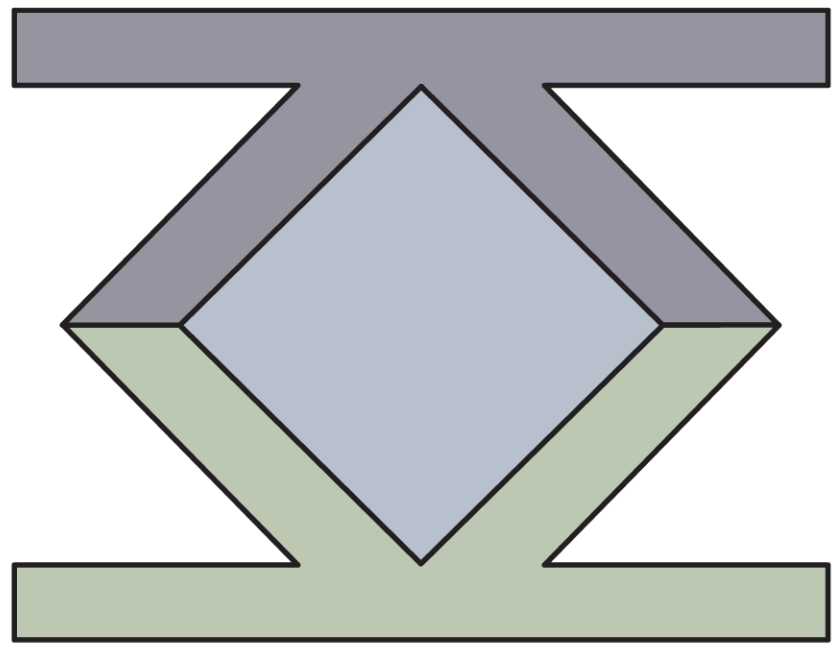

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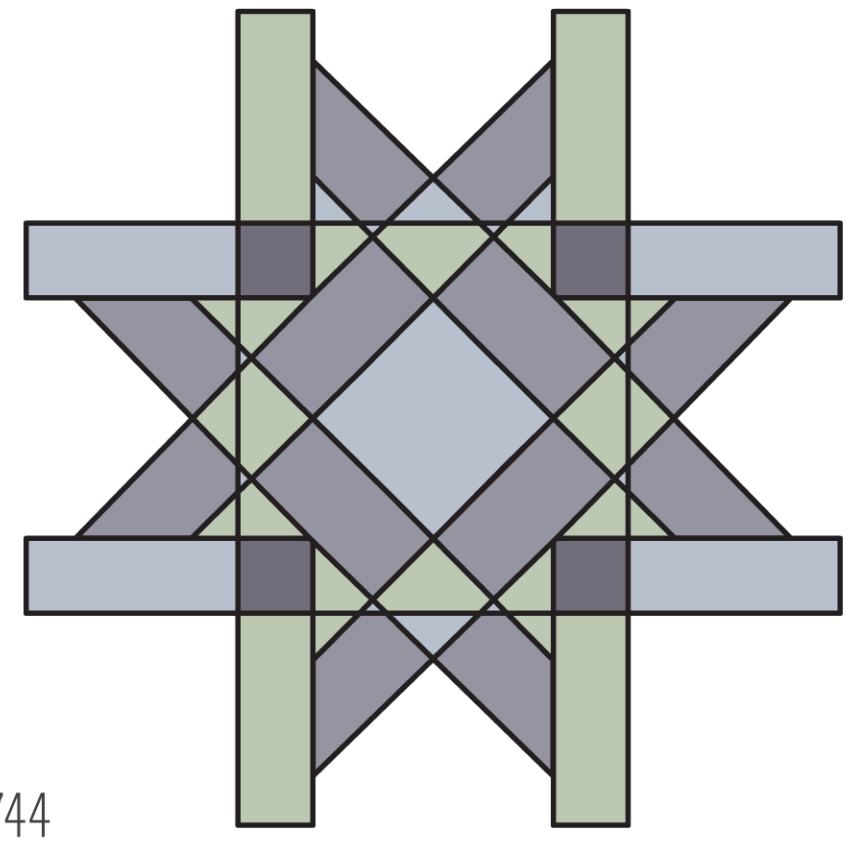

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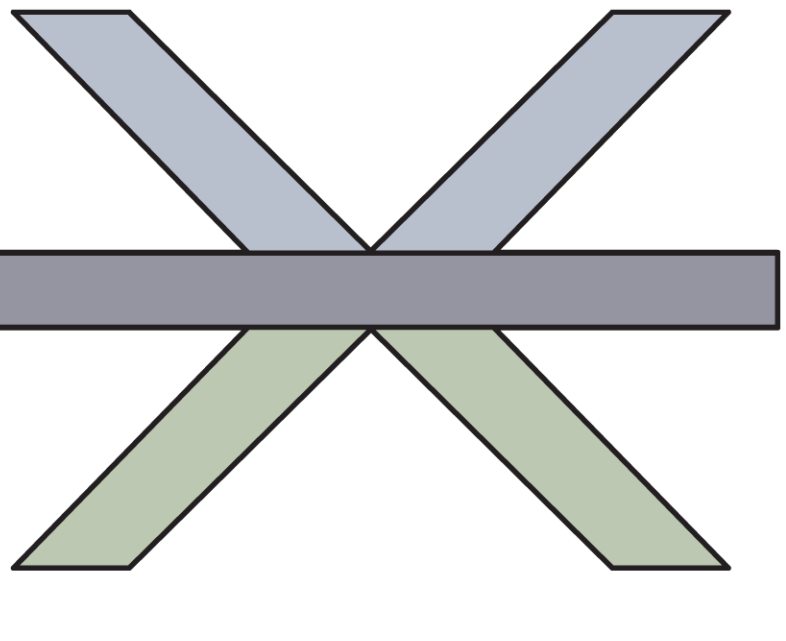

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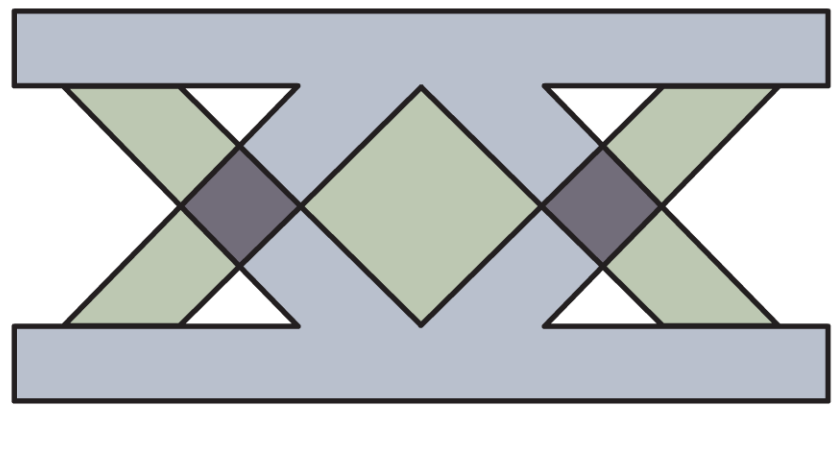

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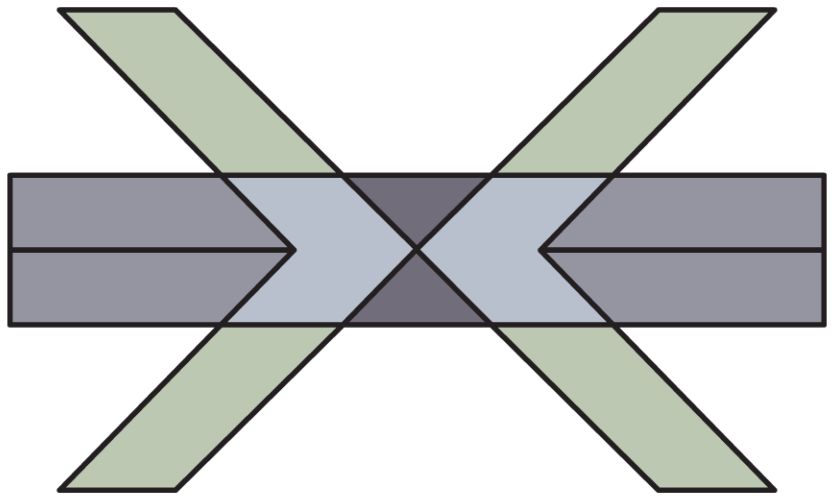

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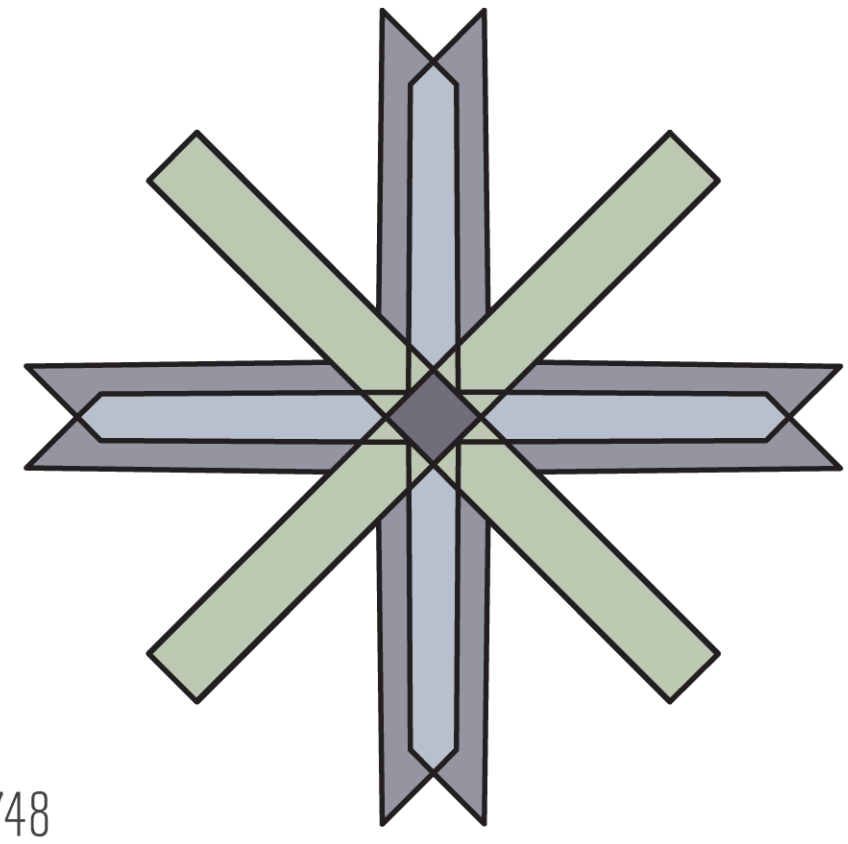

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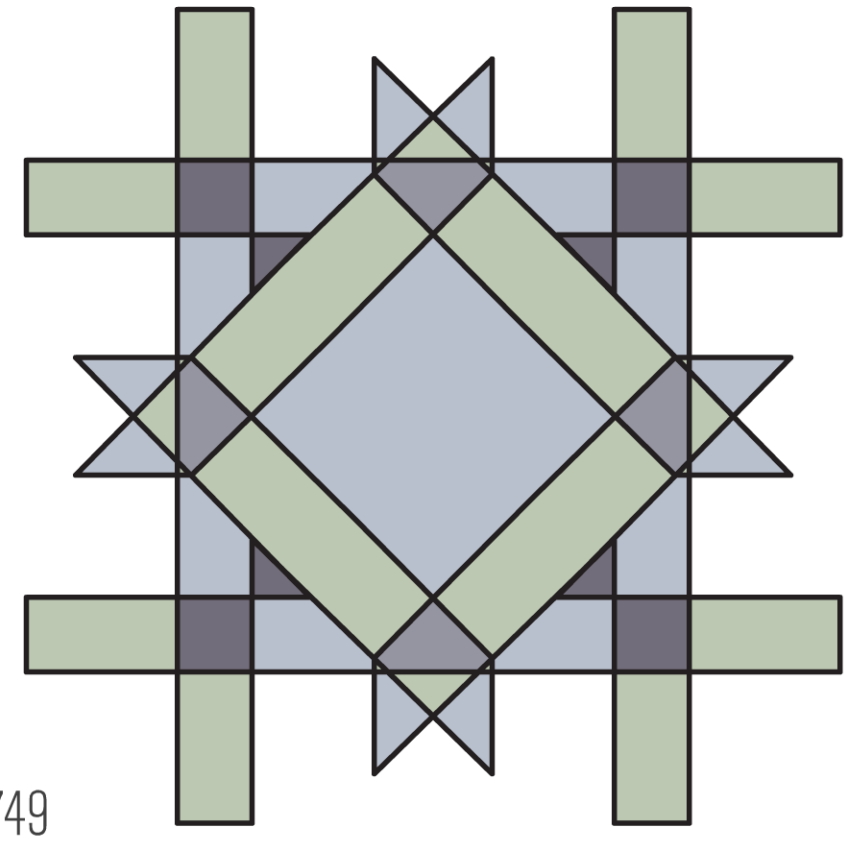

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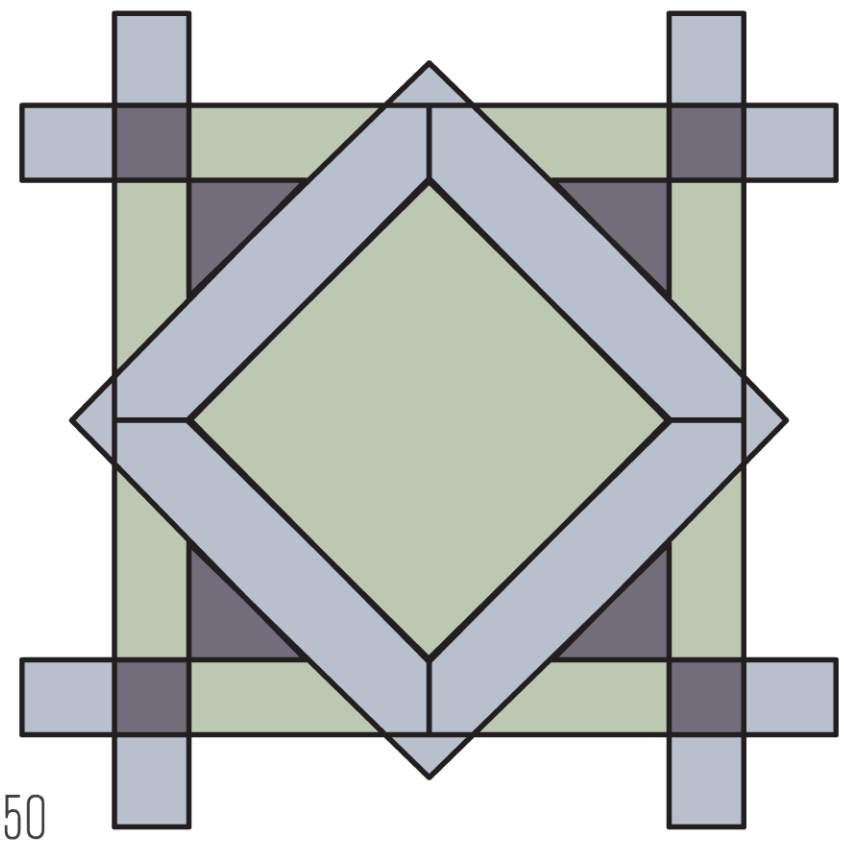

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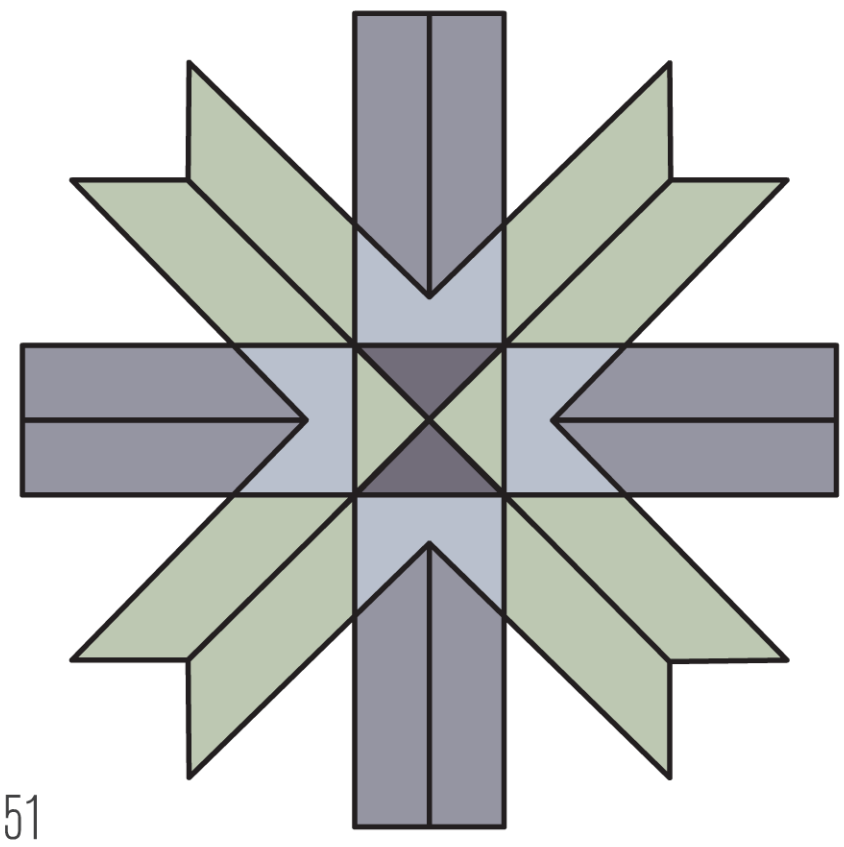

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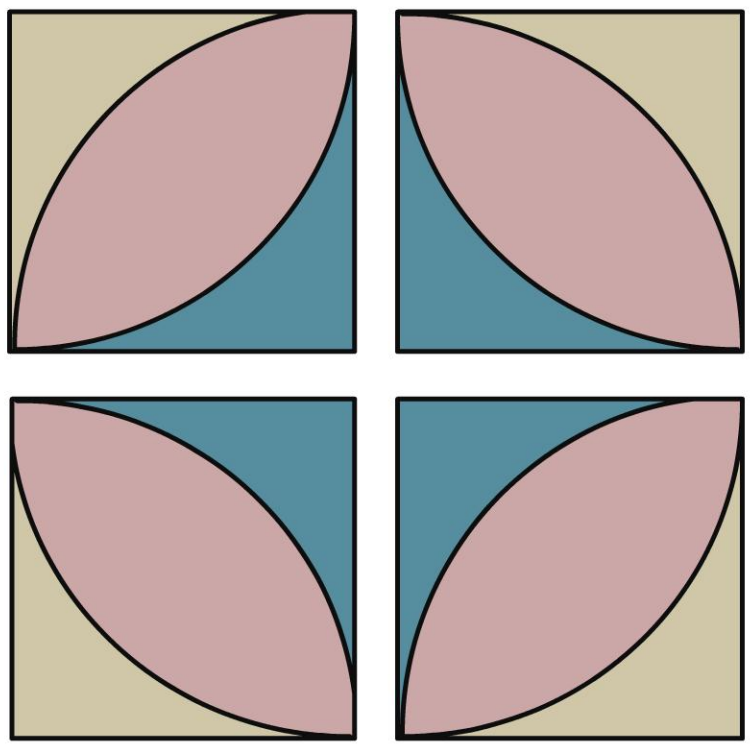

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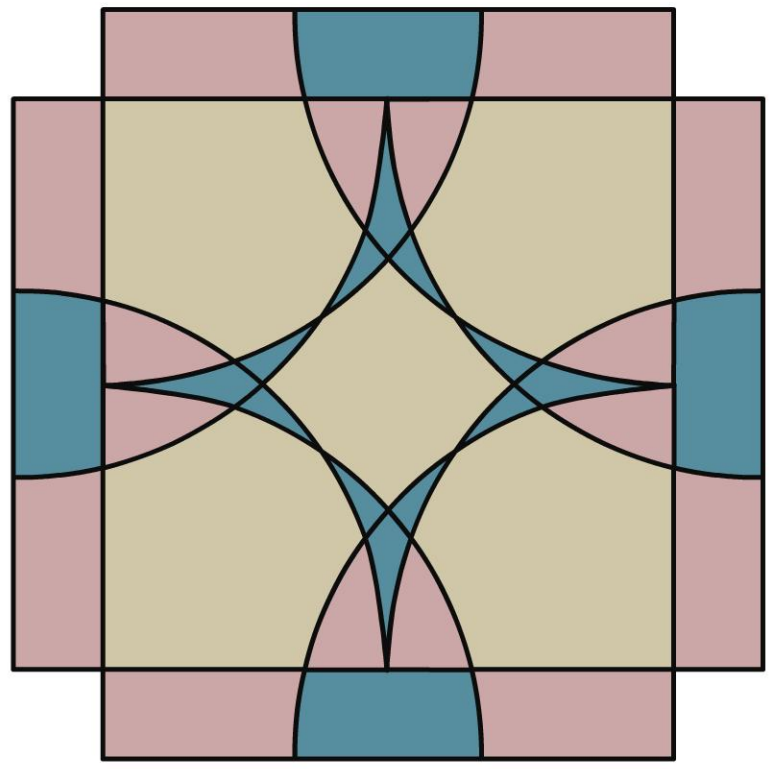

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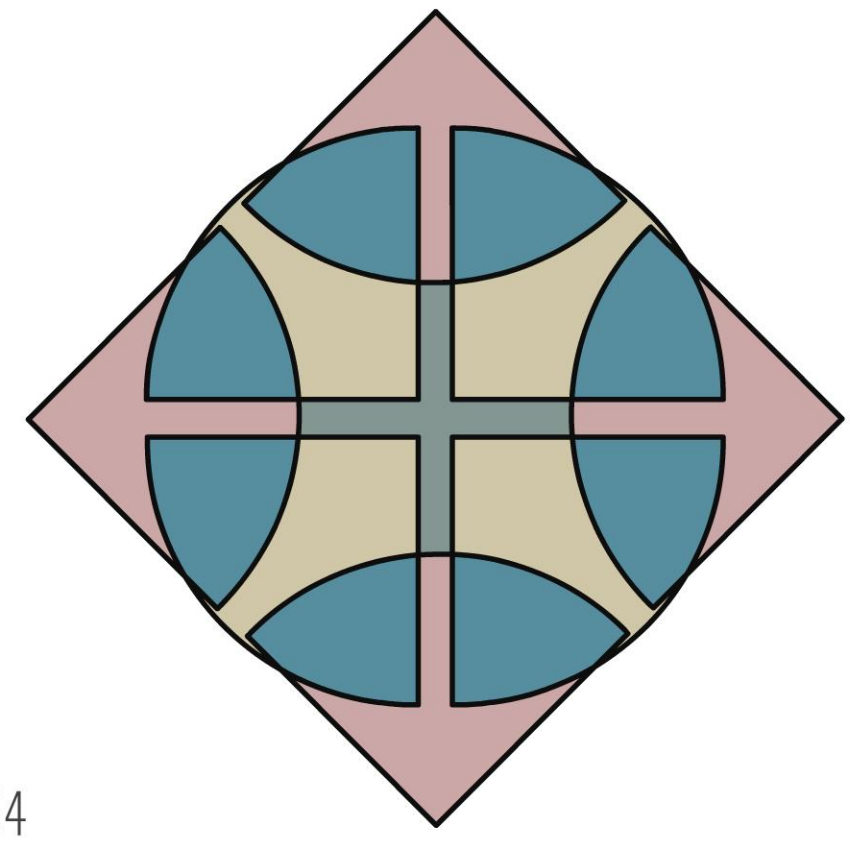

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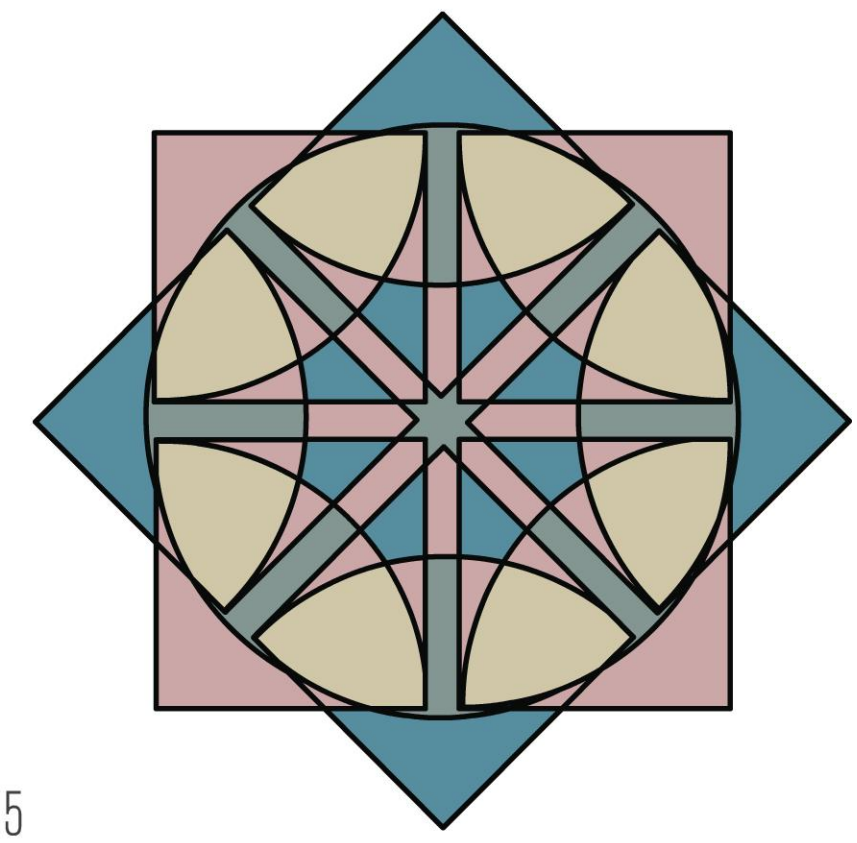

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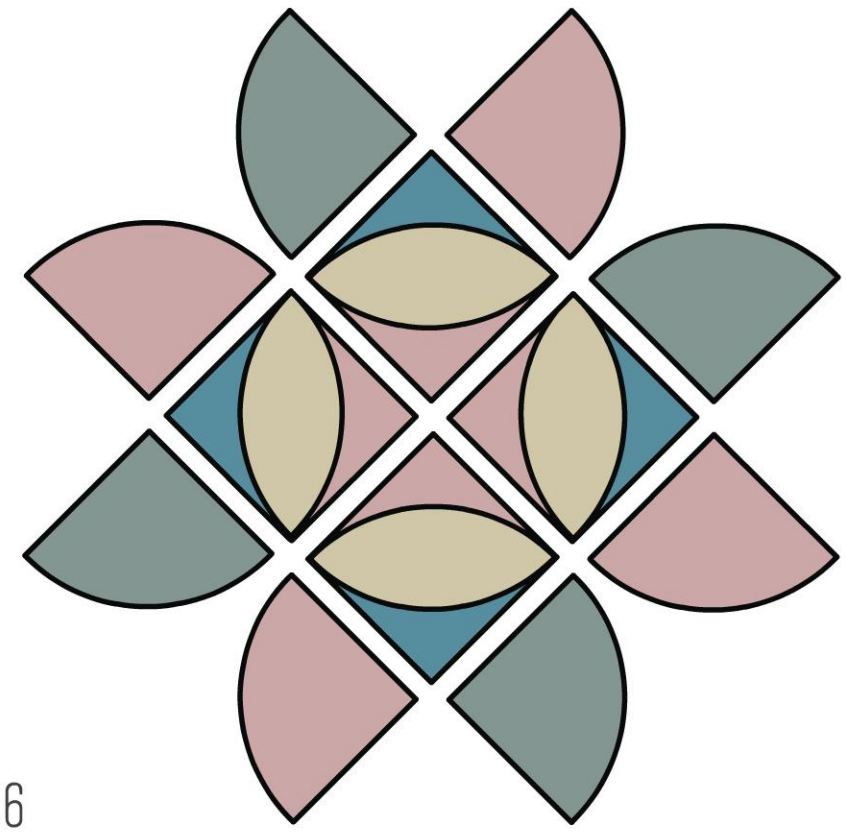

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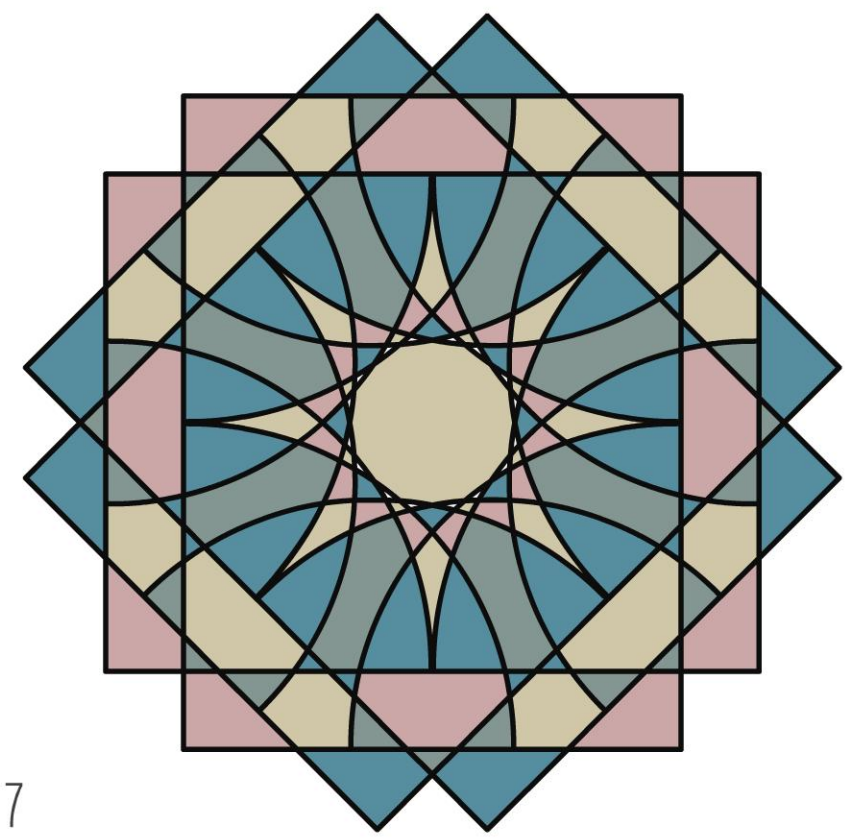

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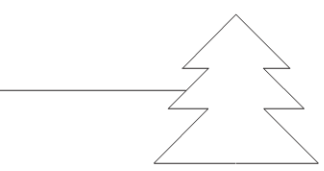
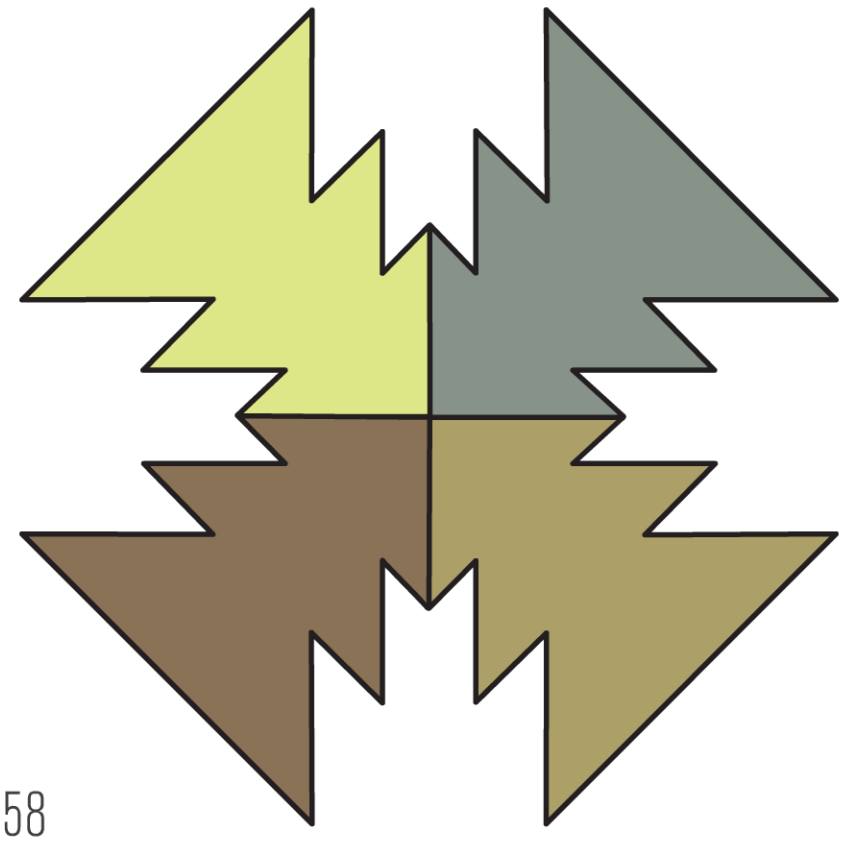


Pine Trees



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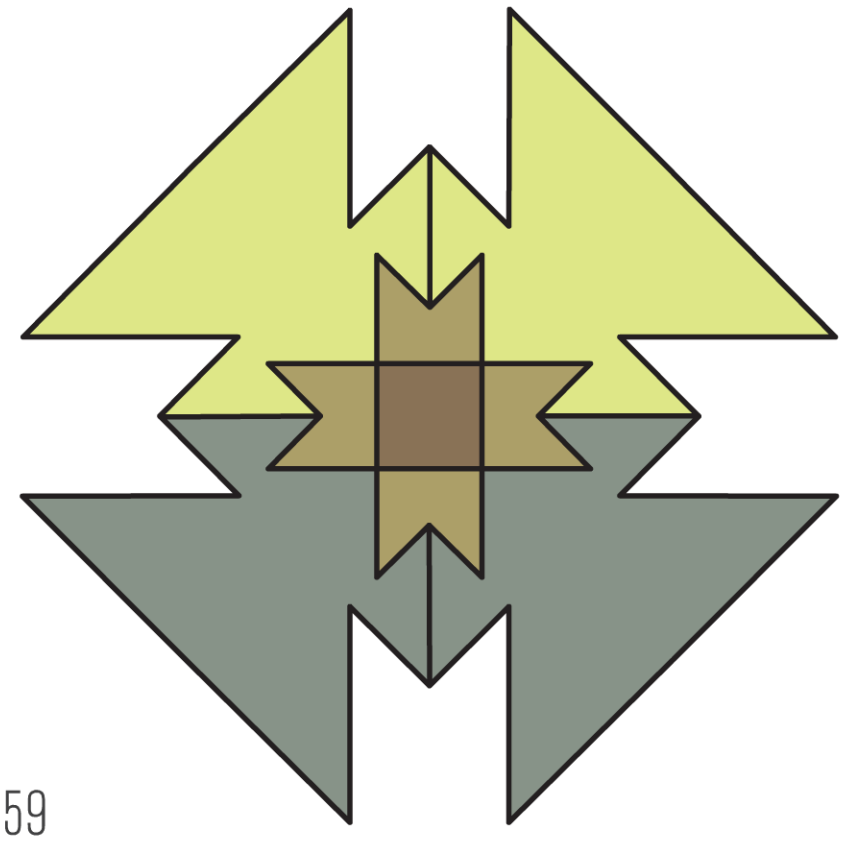

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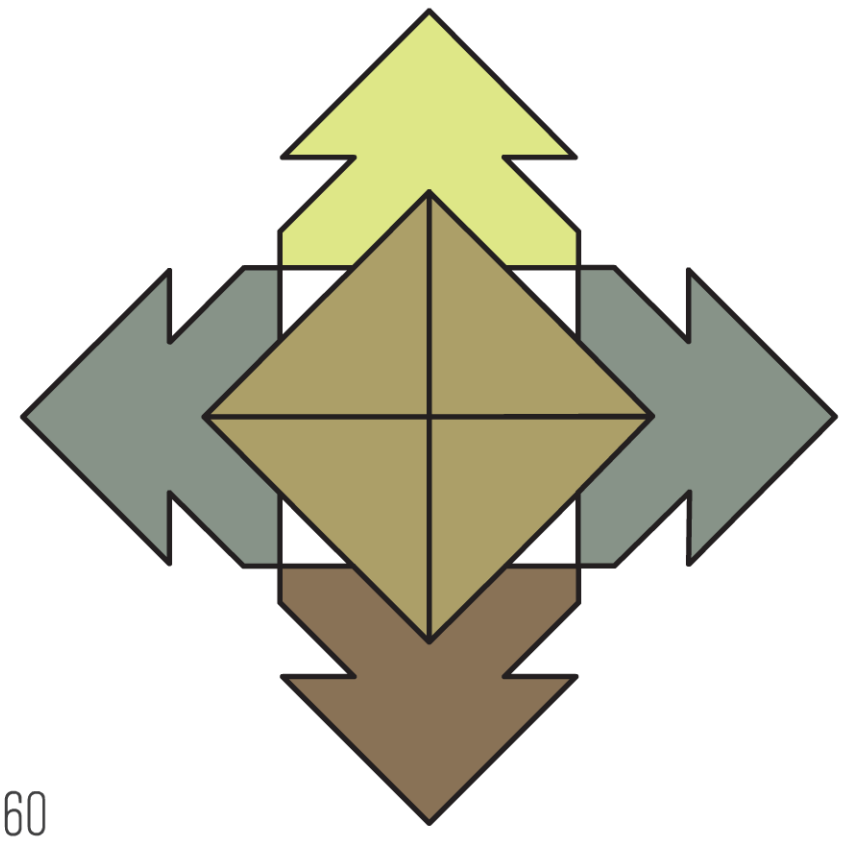

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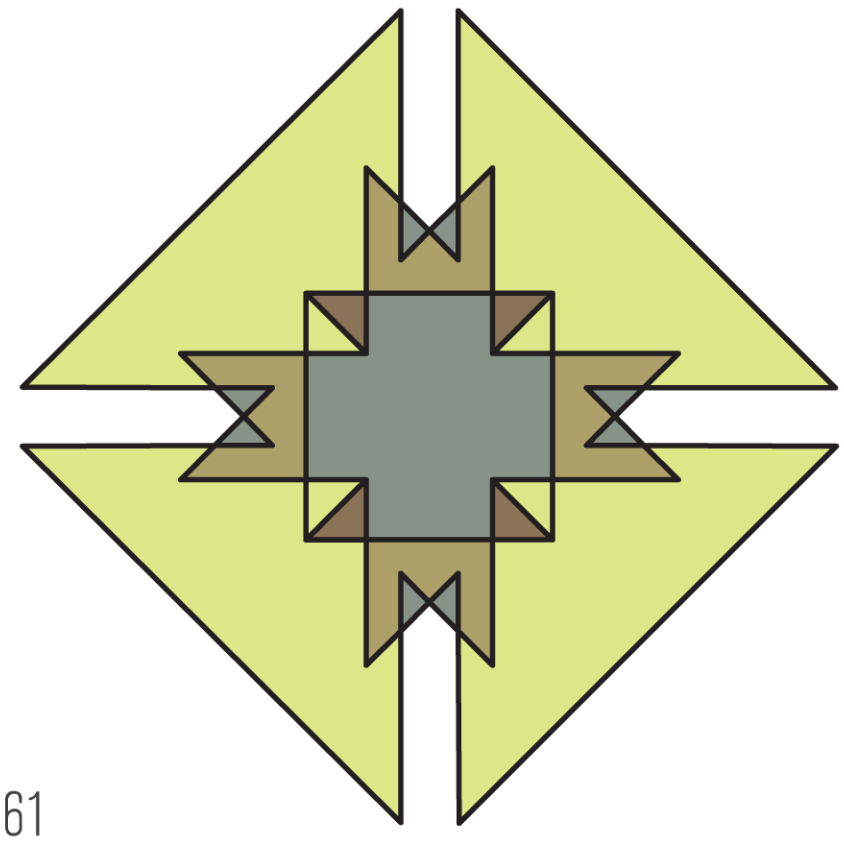

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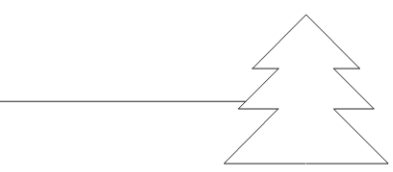
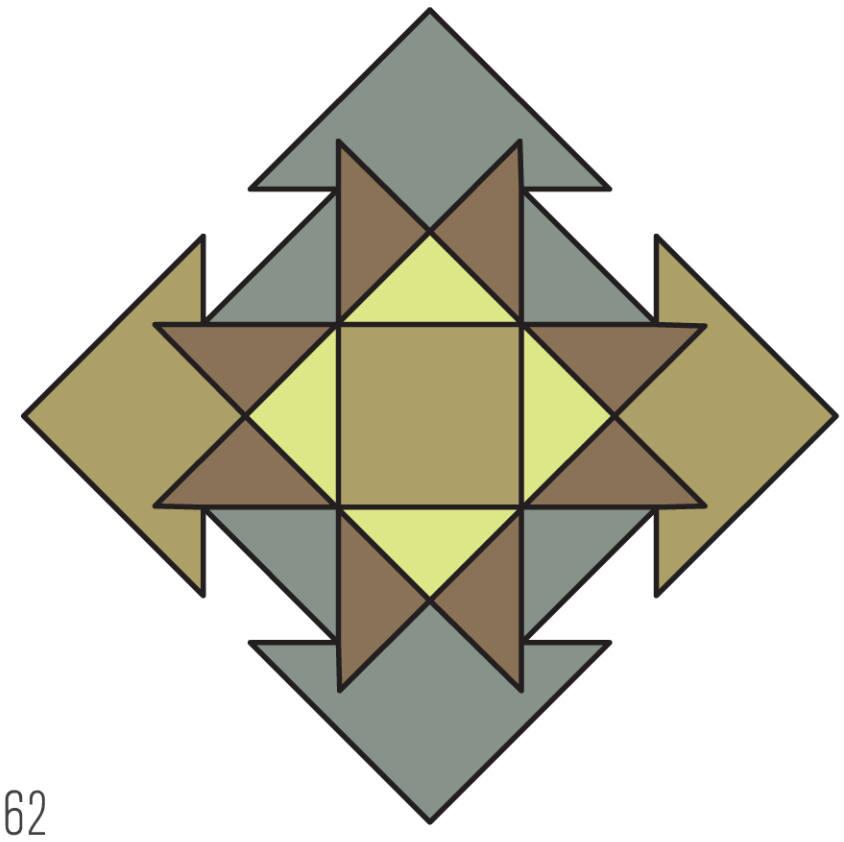


Pine Trees



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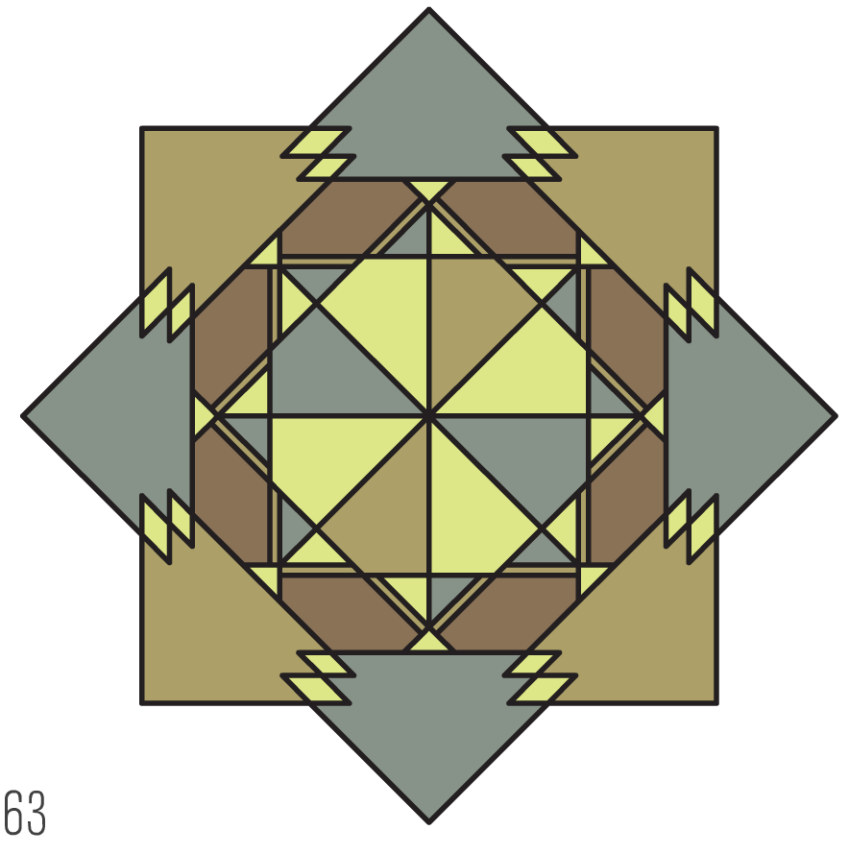

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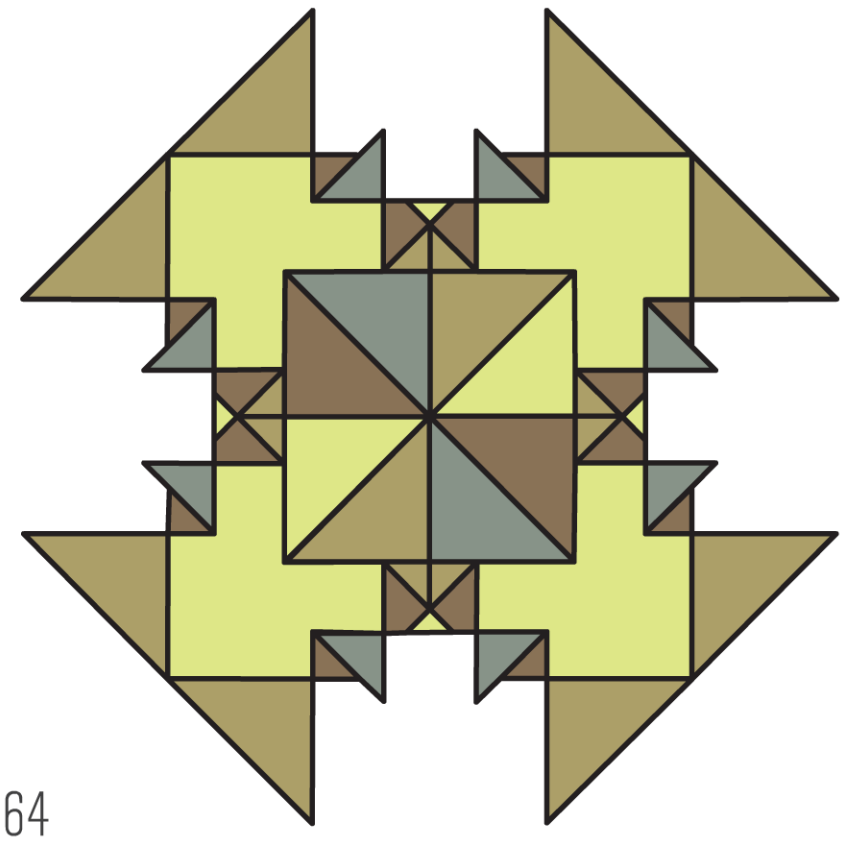

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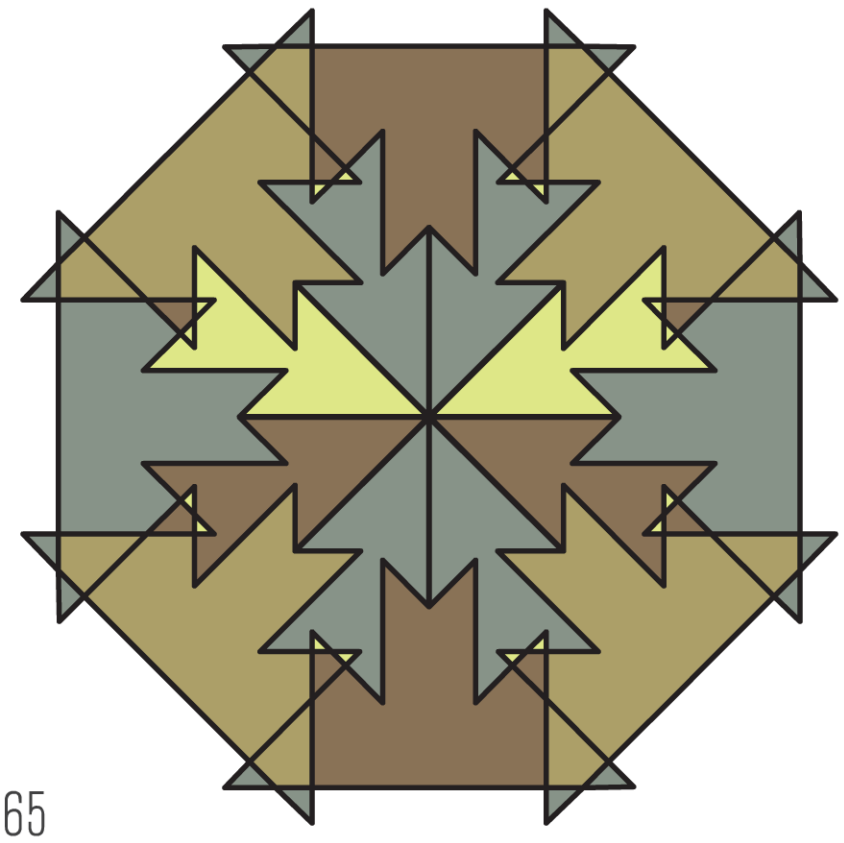

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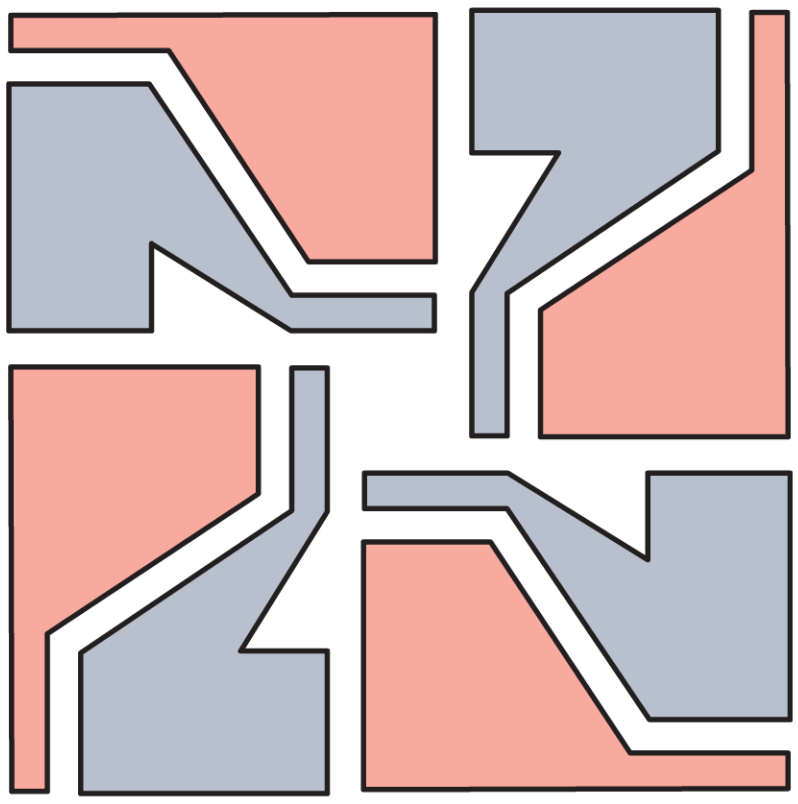

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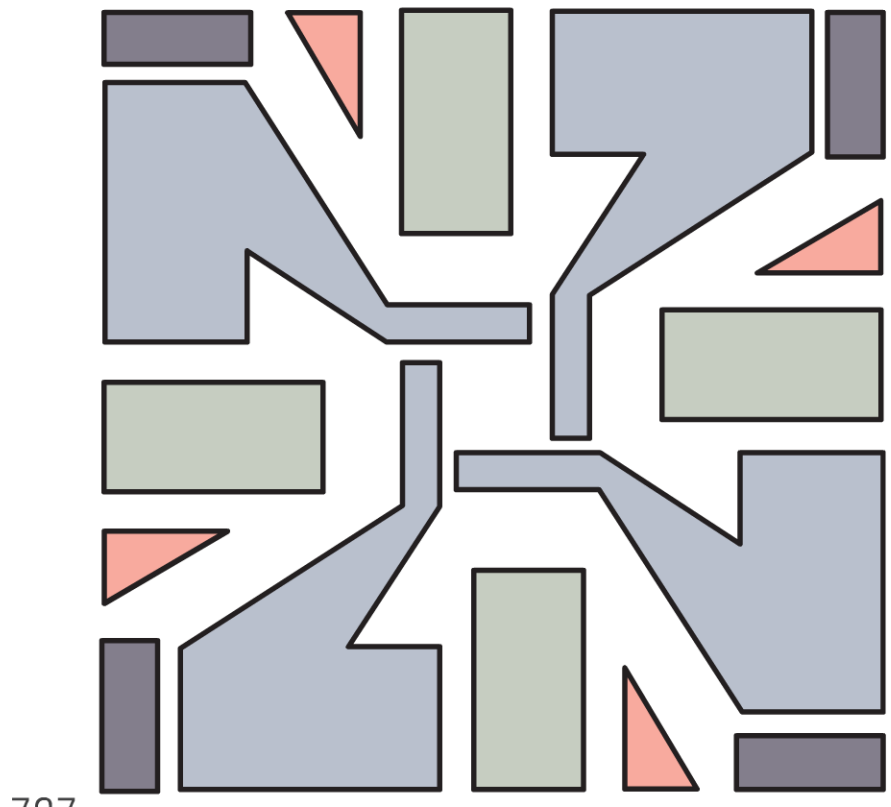

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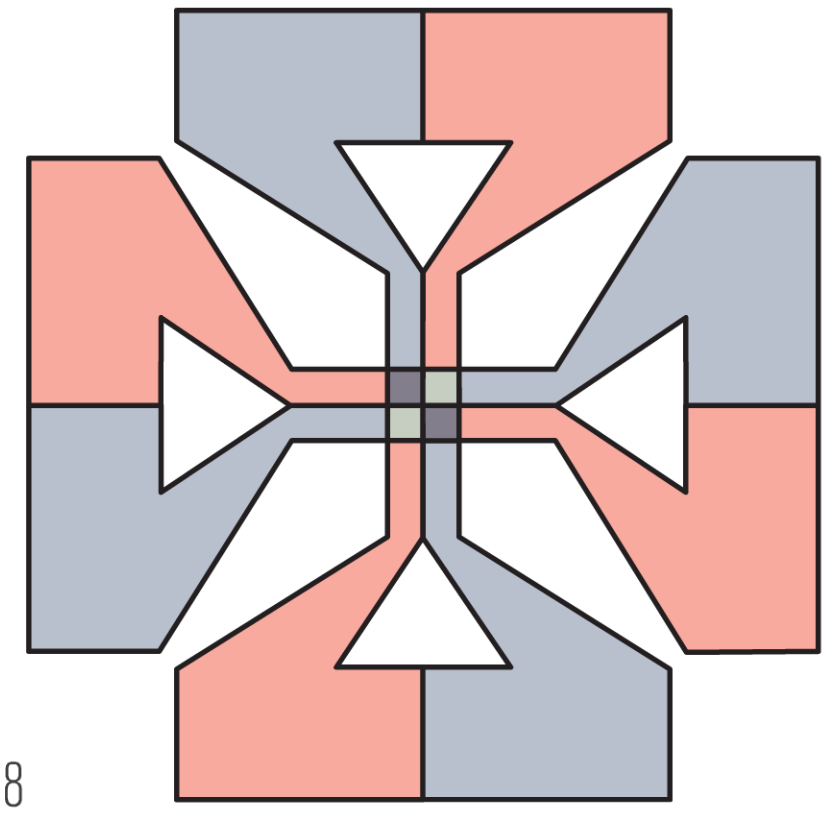

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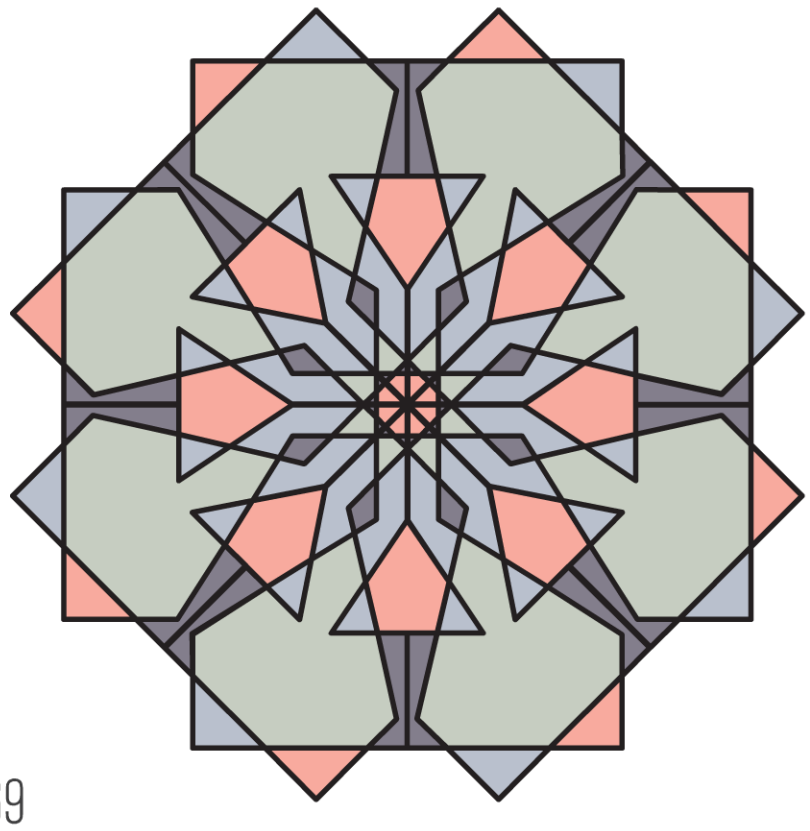

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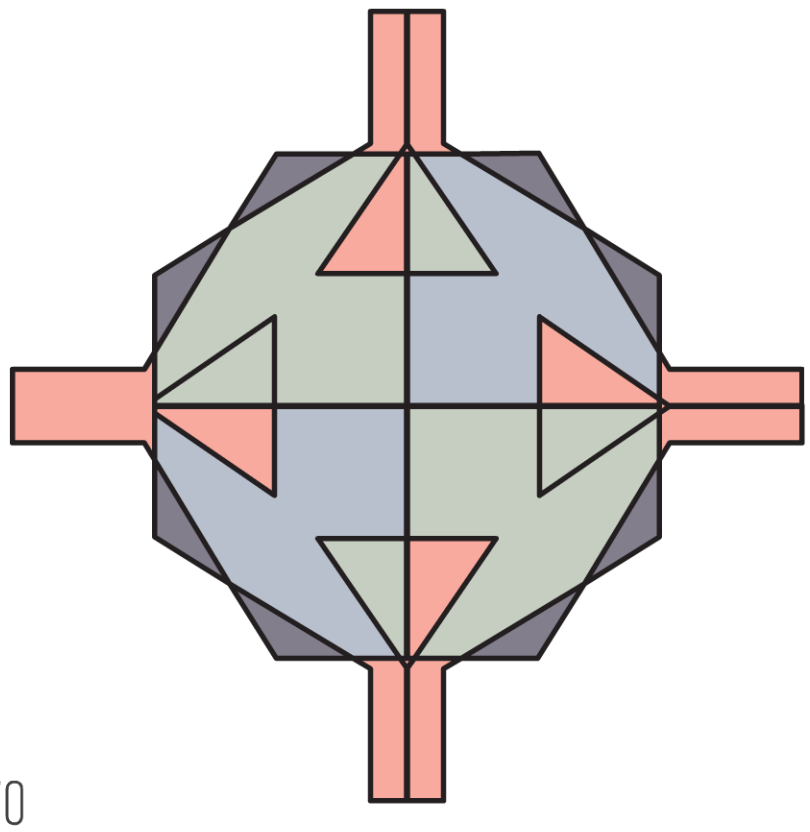

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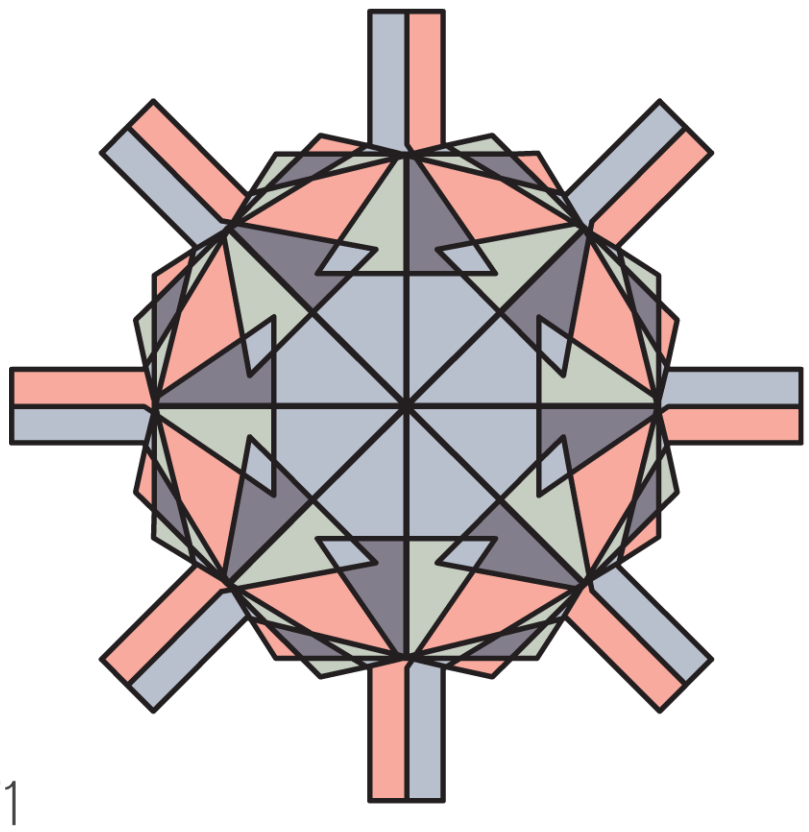

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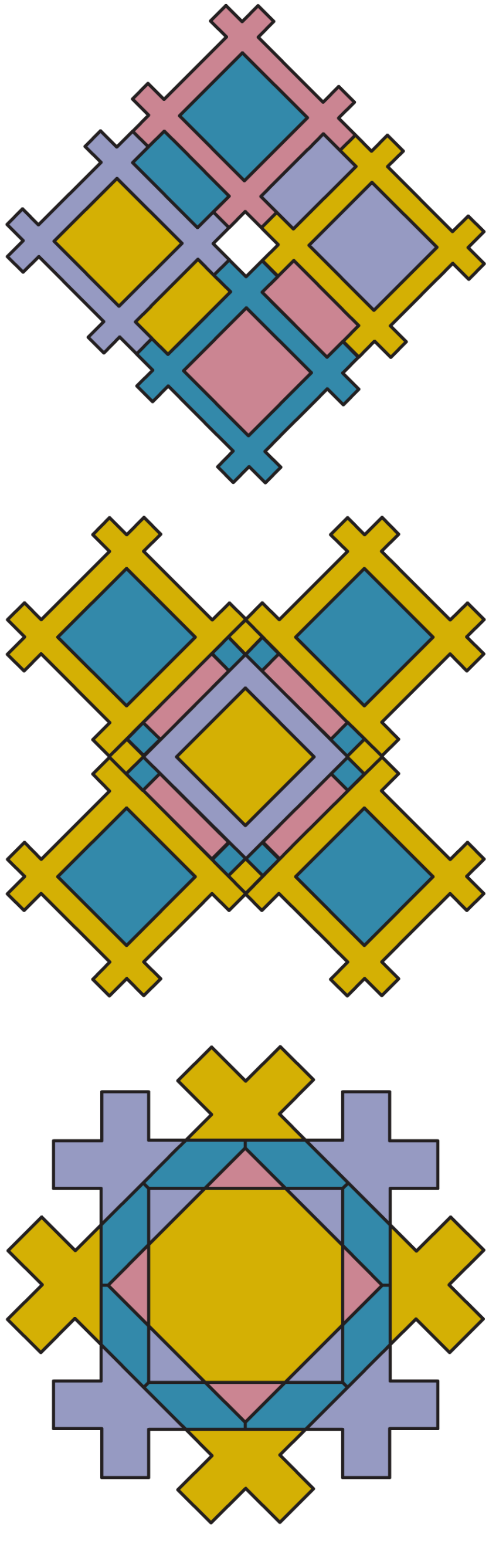

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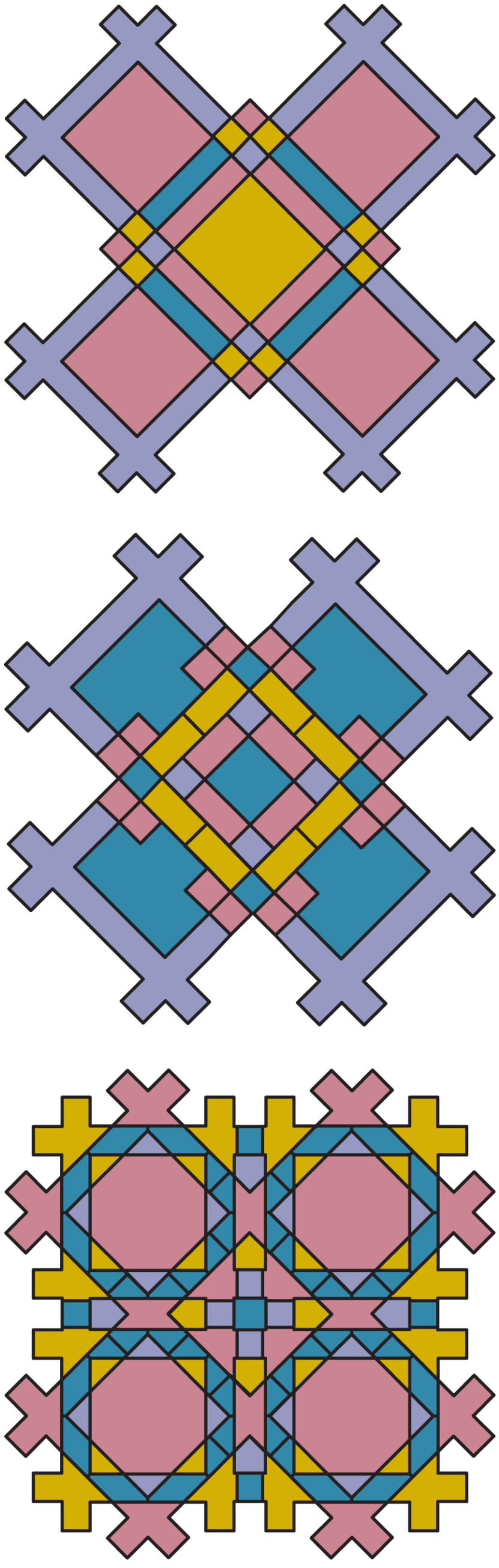

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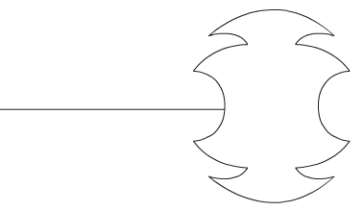

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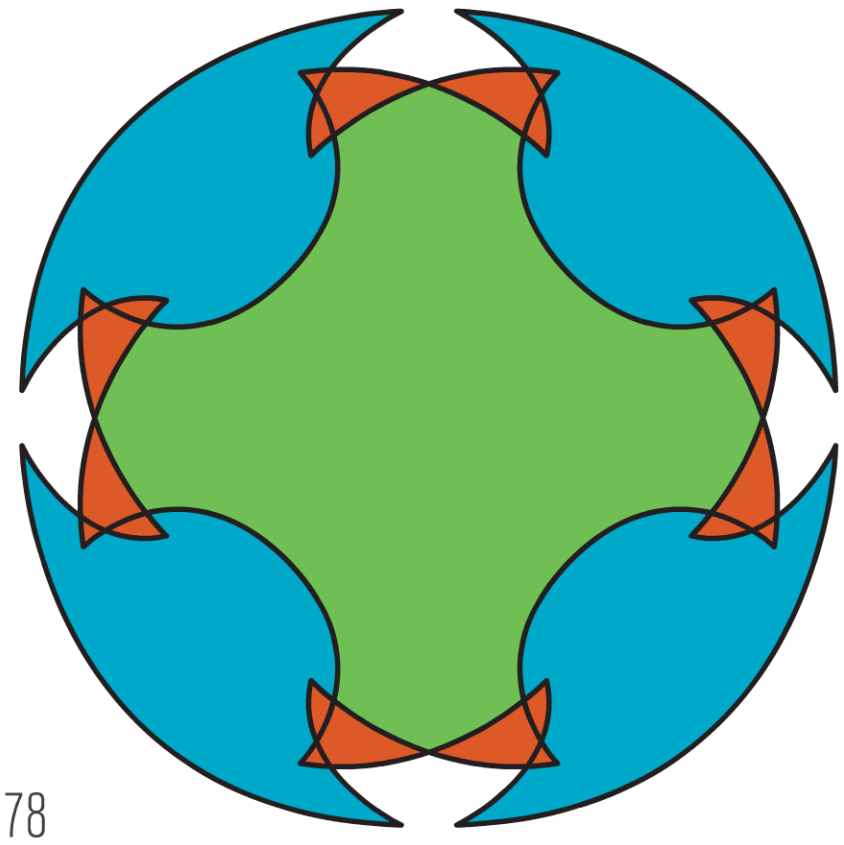

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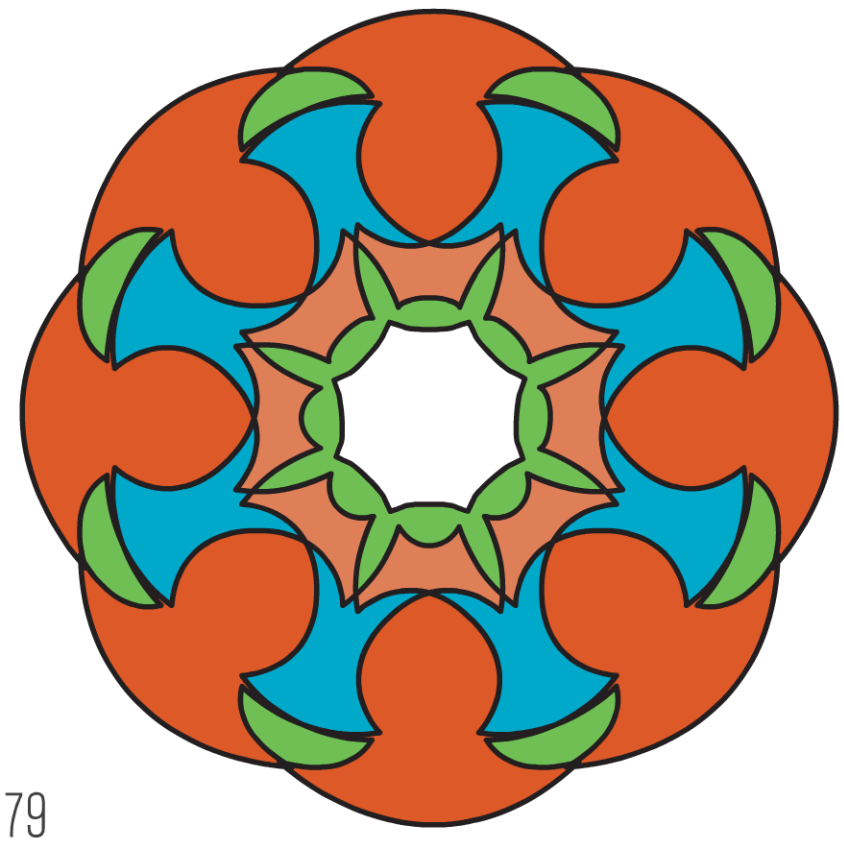

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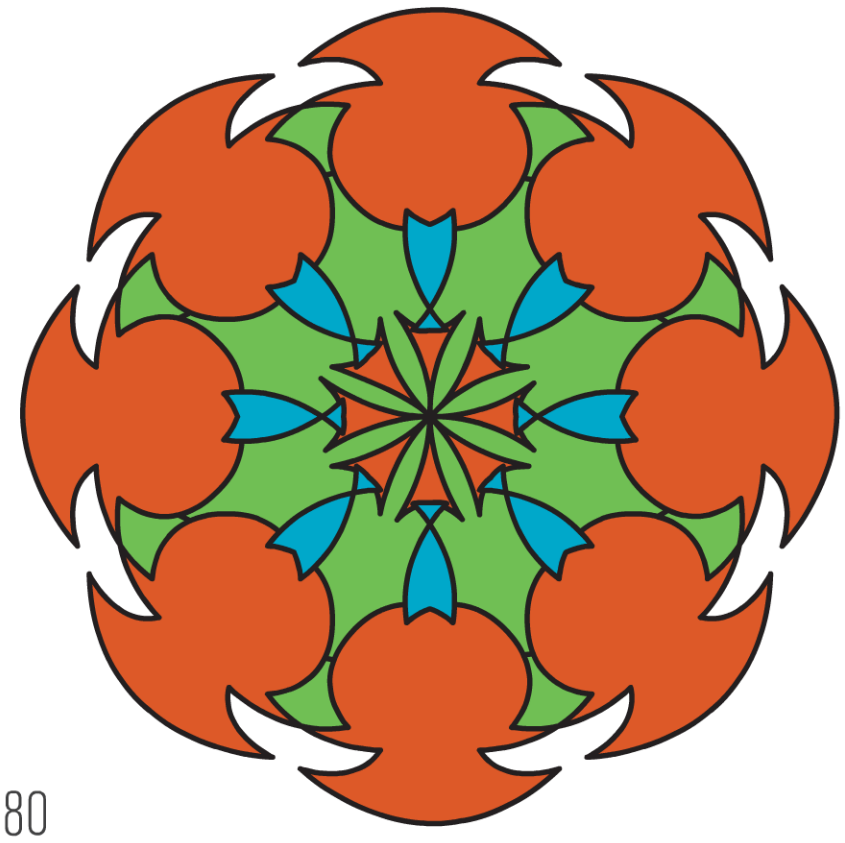

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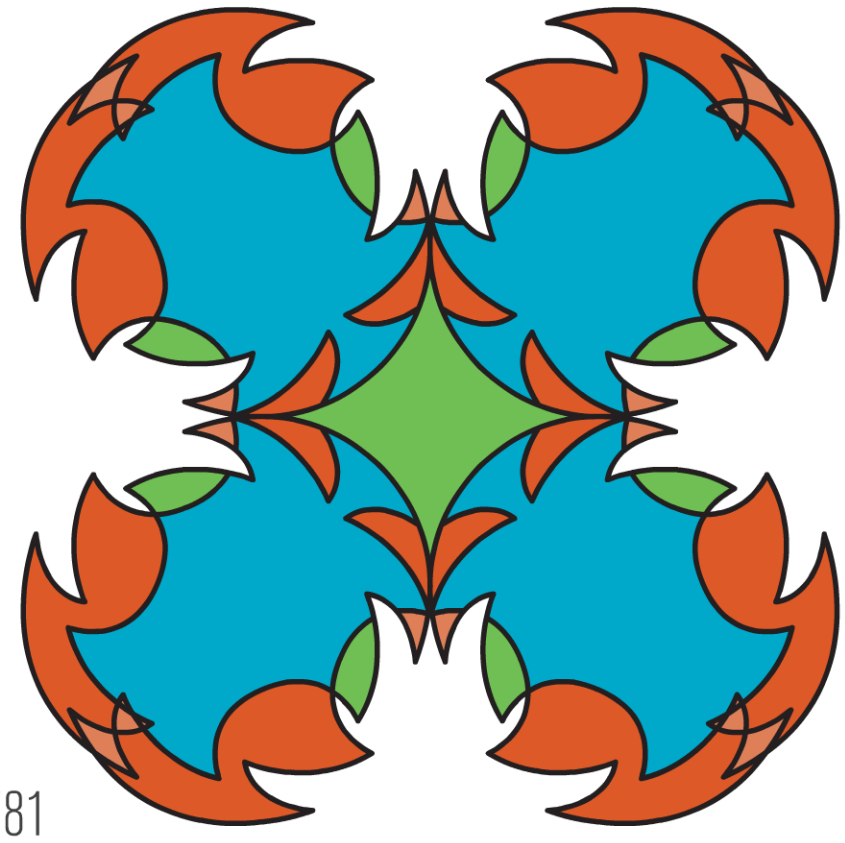

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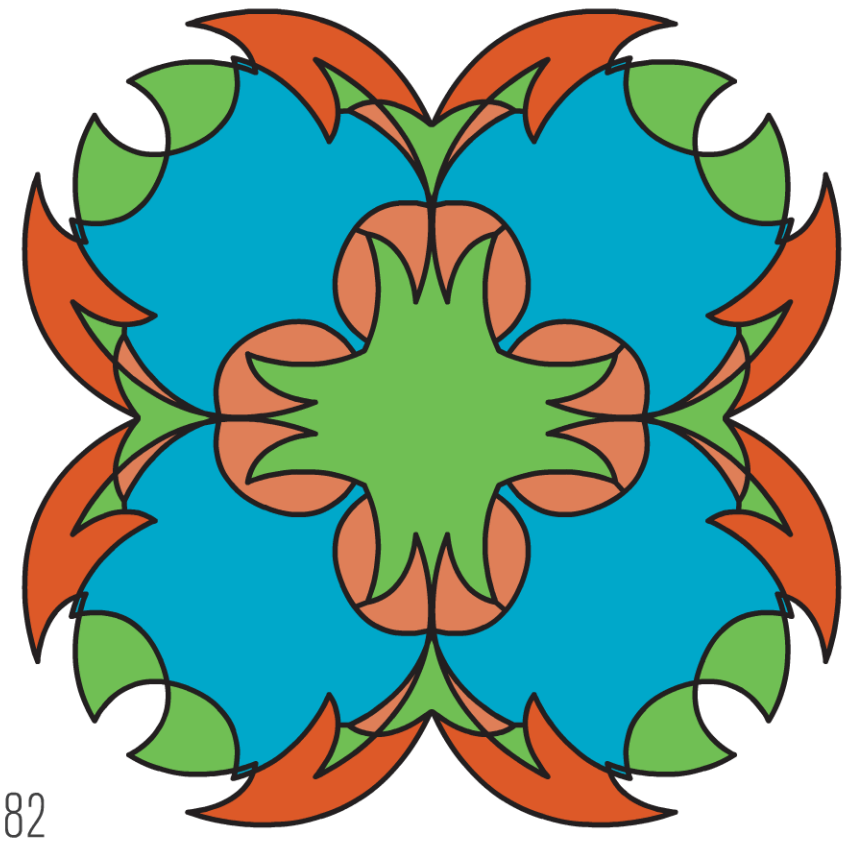

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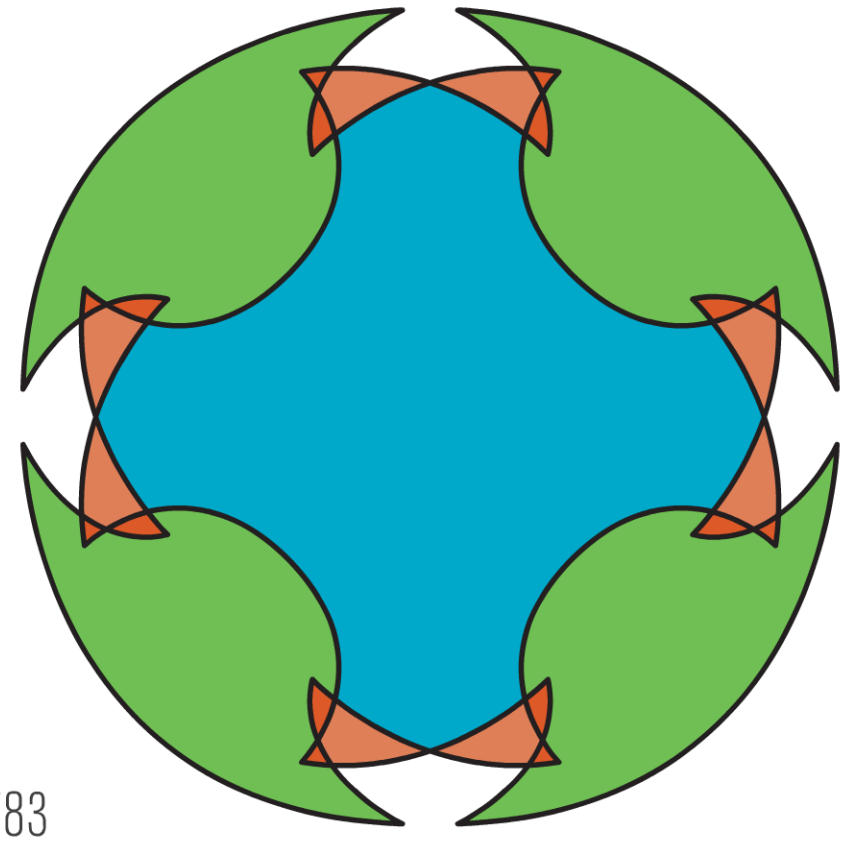

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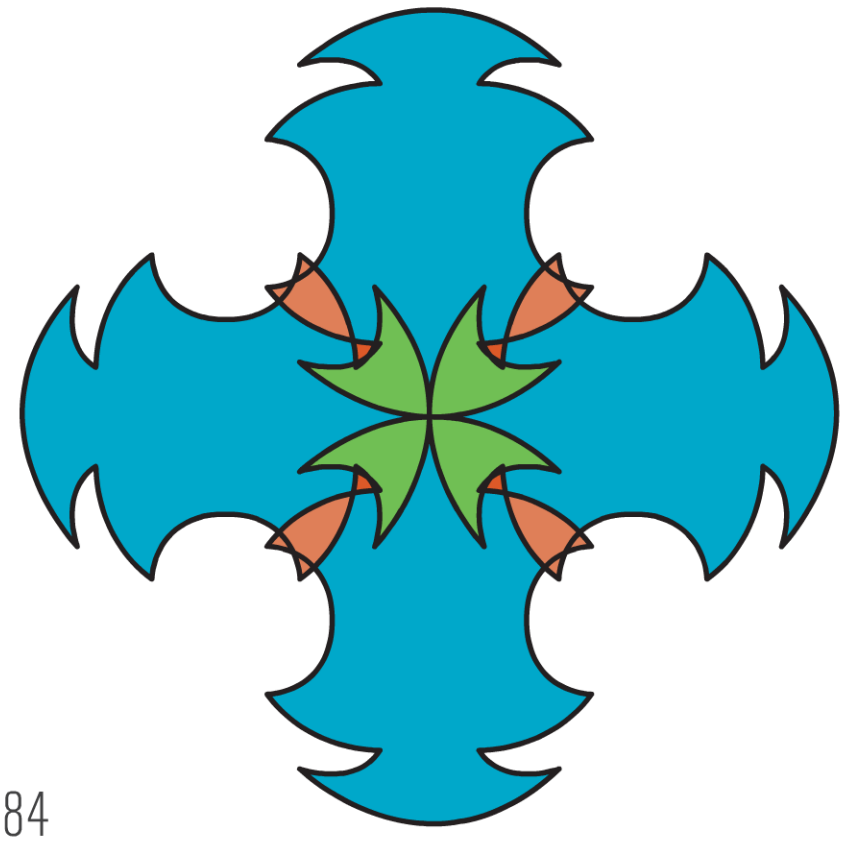

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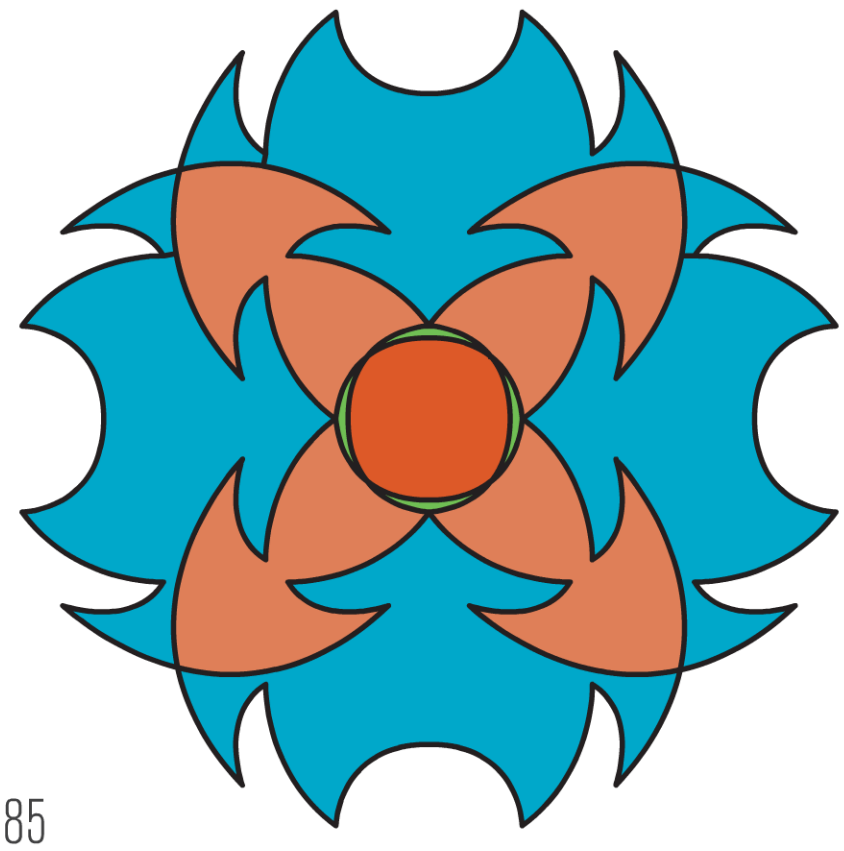

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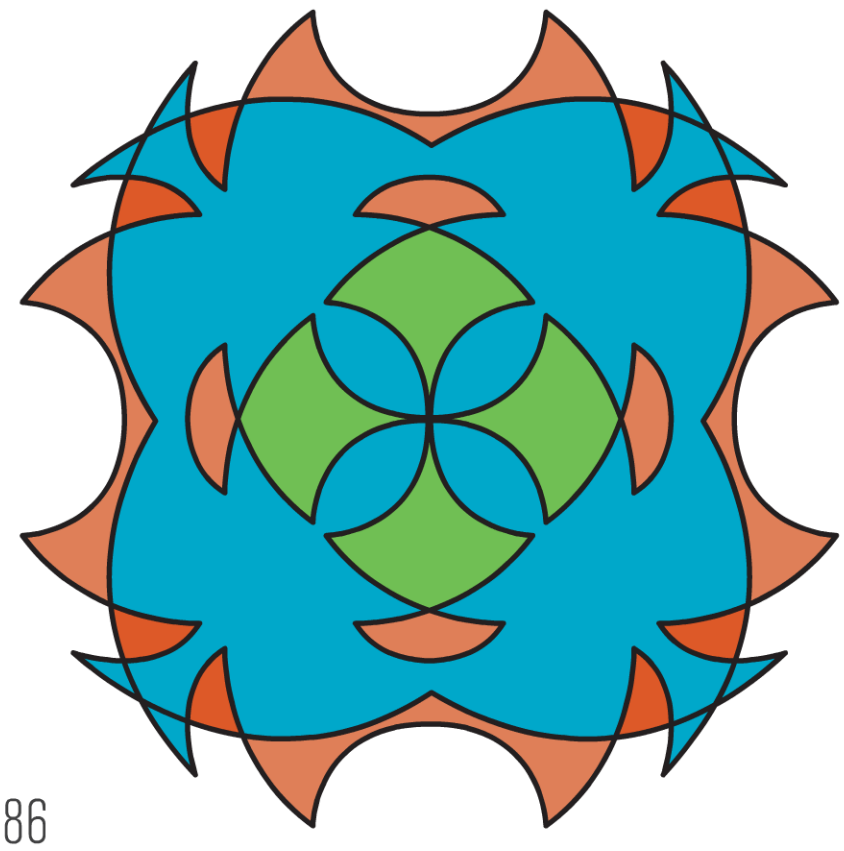

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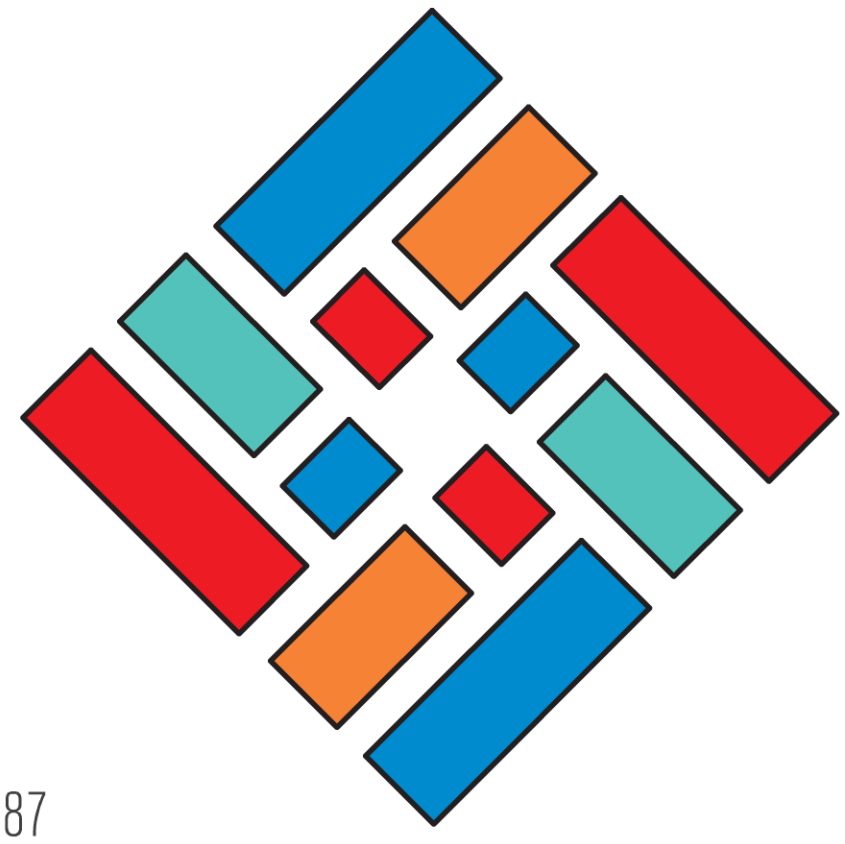
Rectangles



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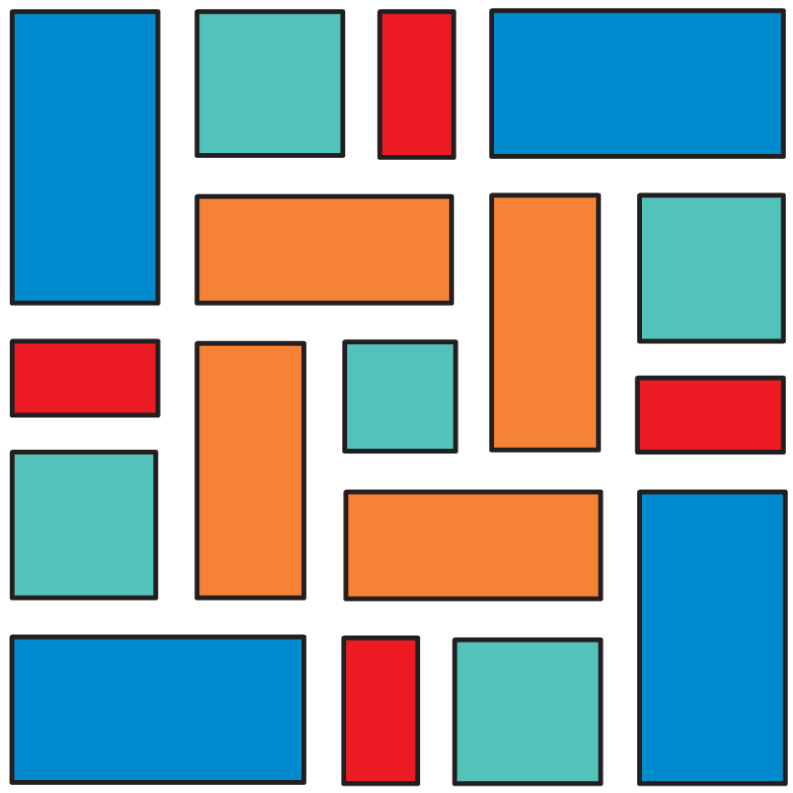

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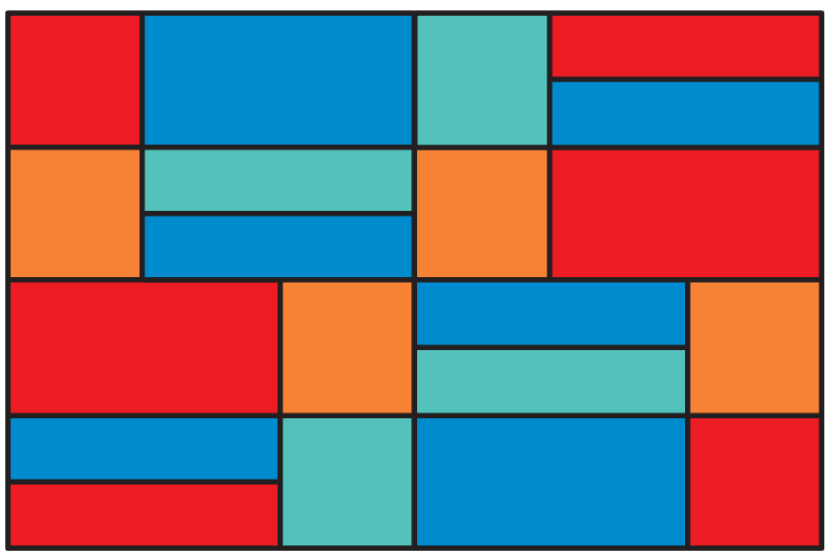

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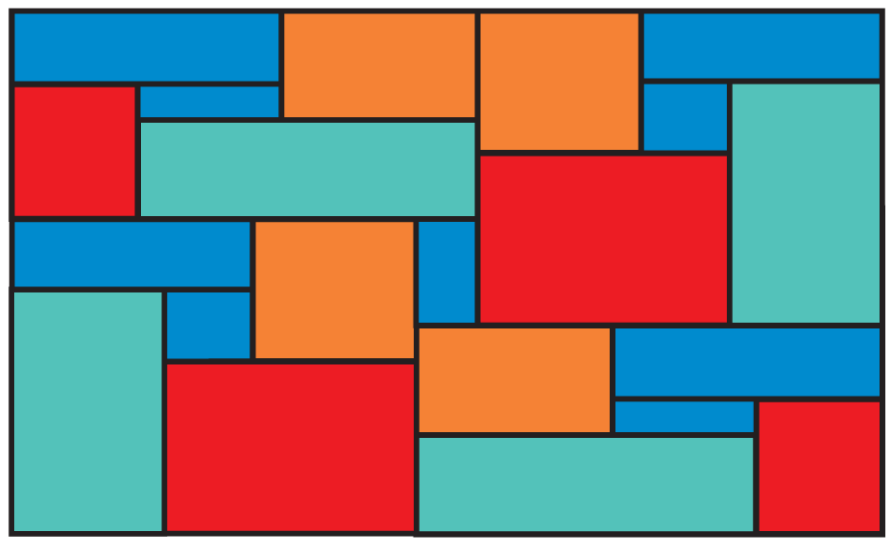

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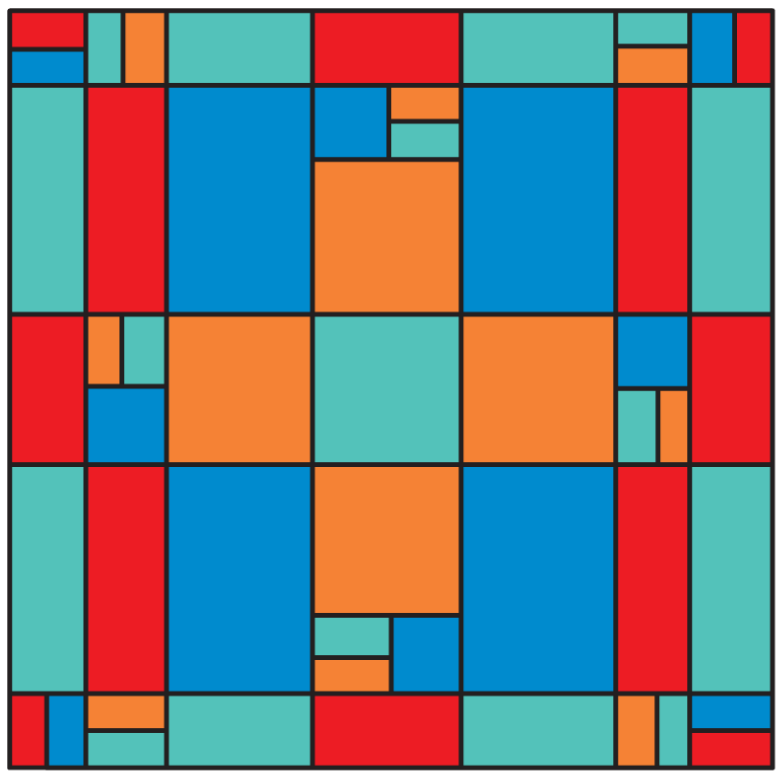

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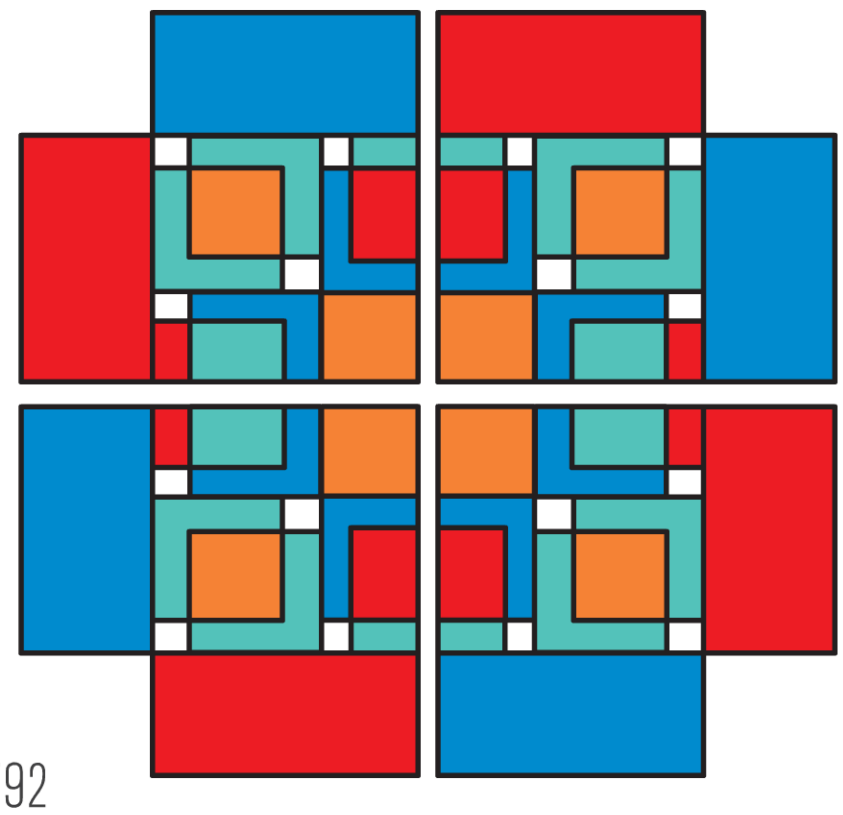

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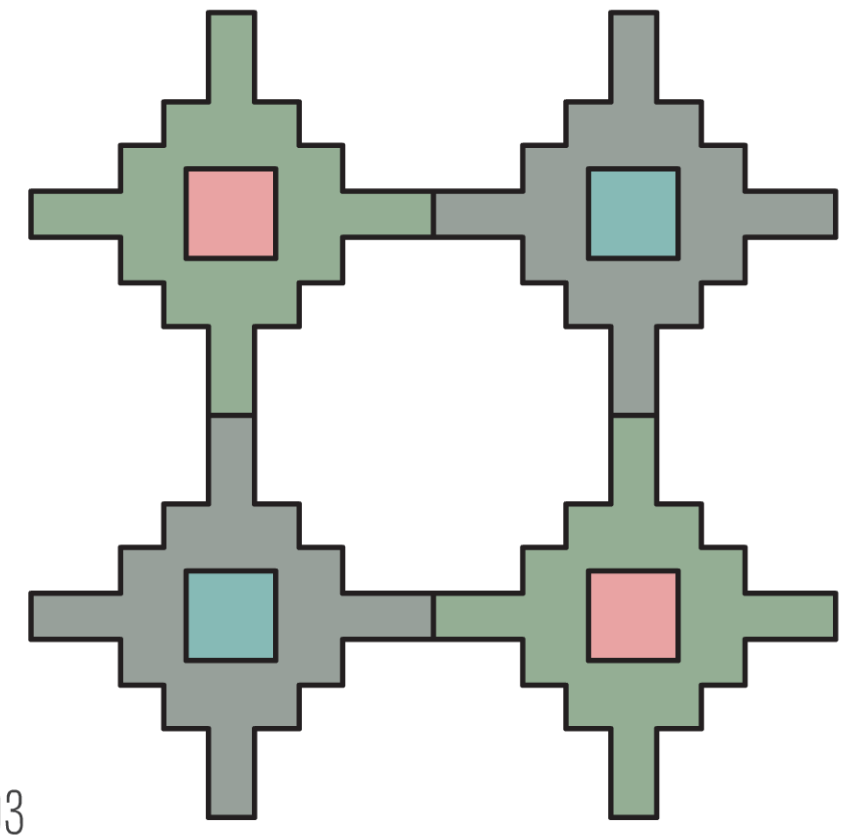
Reticules



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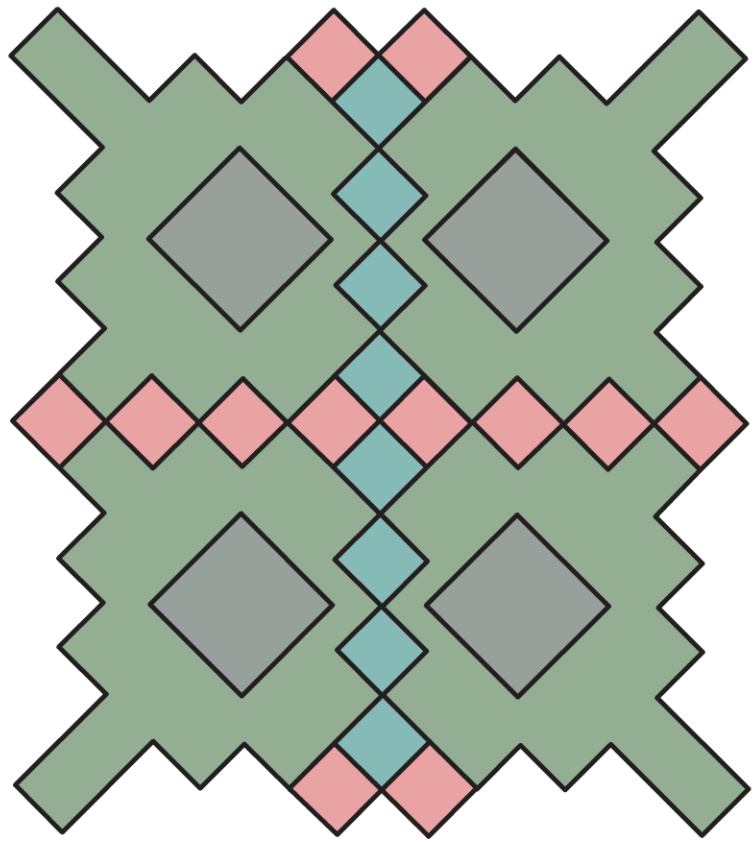

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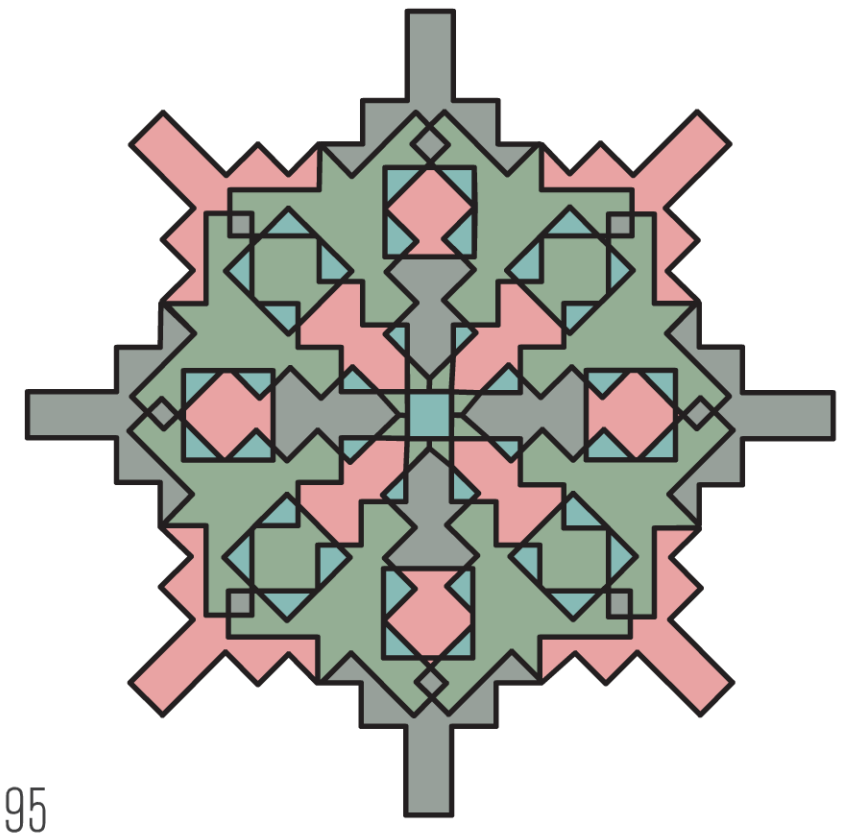

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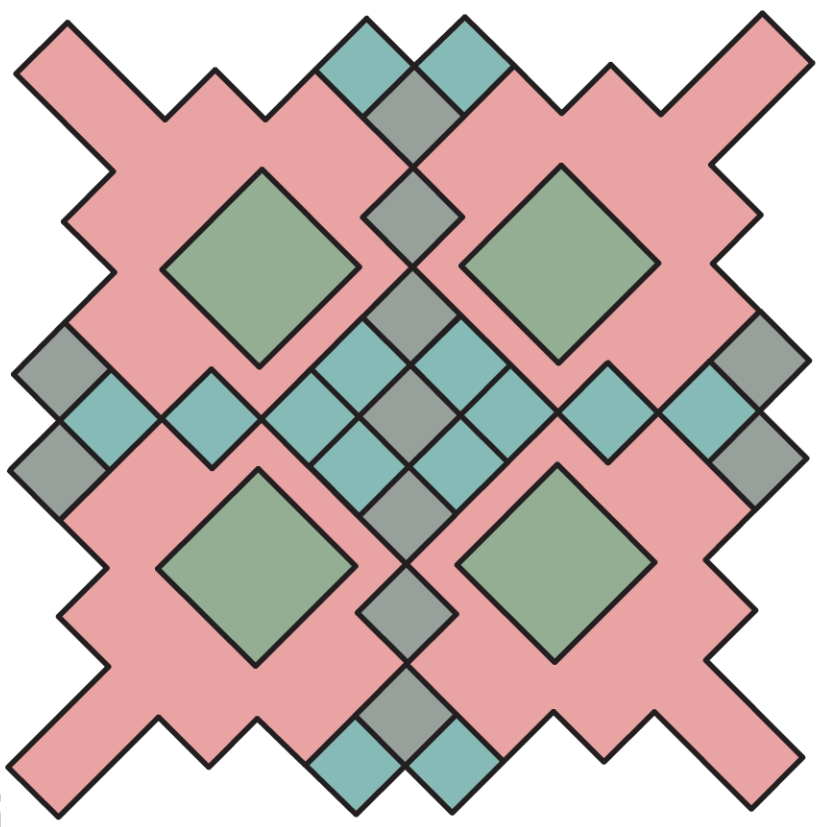

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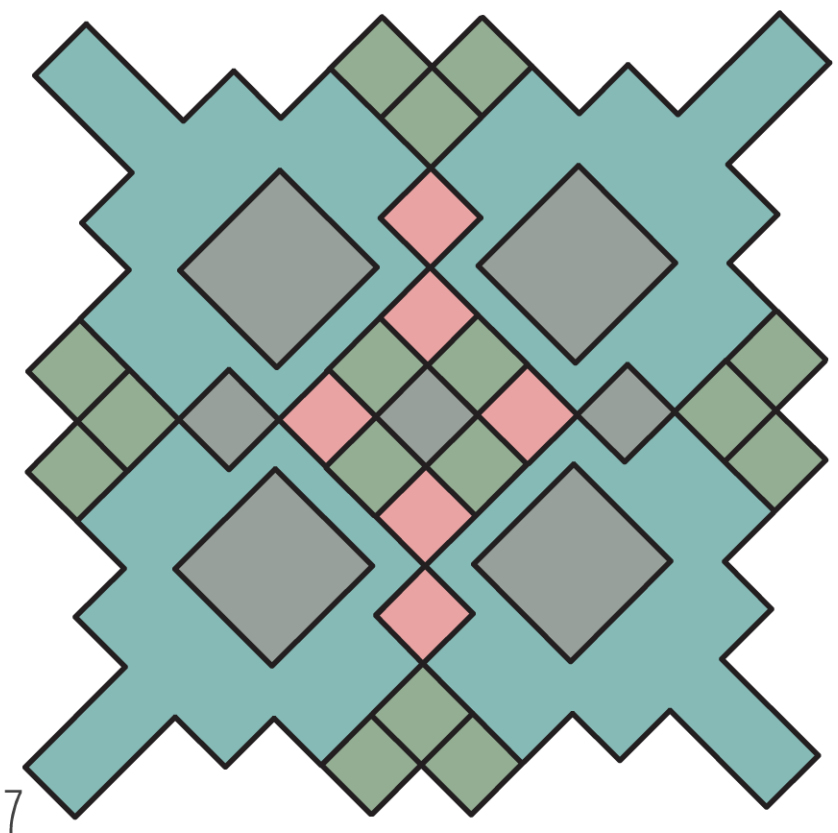

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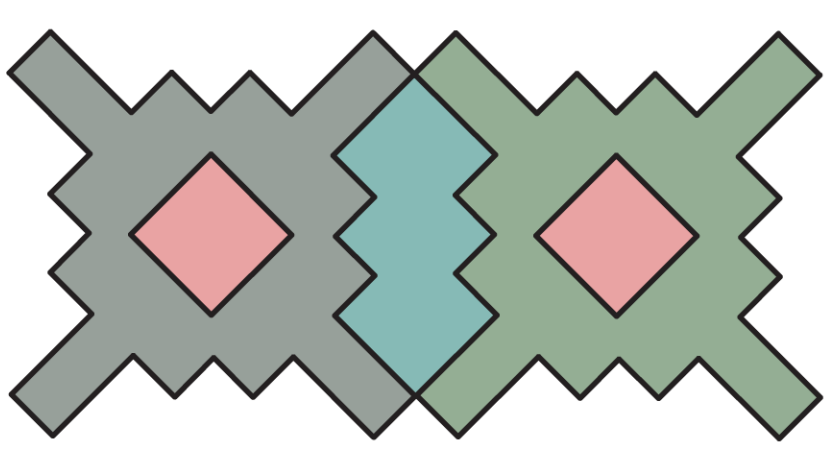

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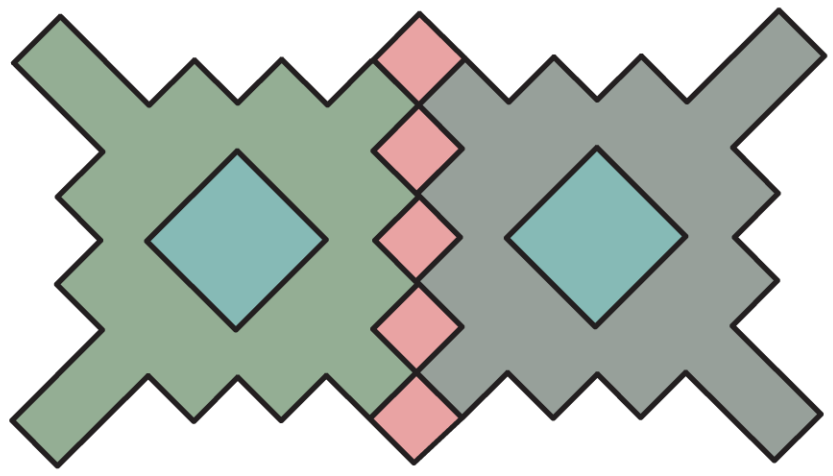

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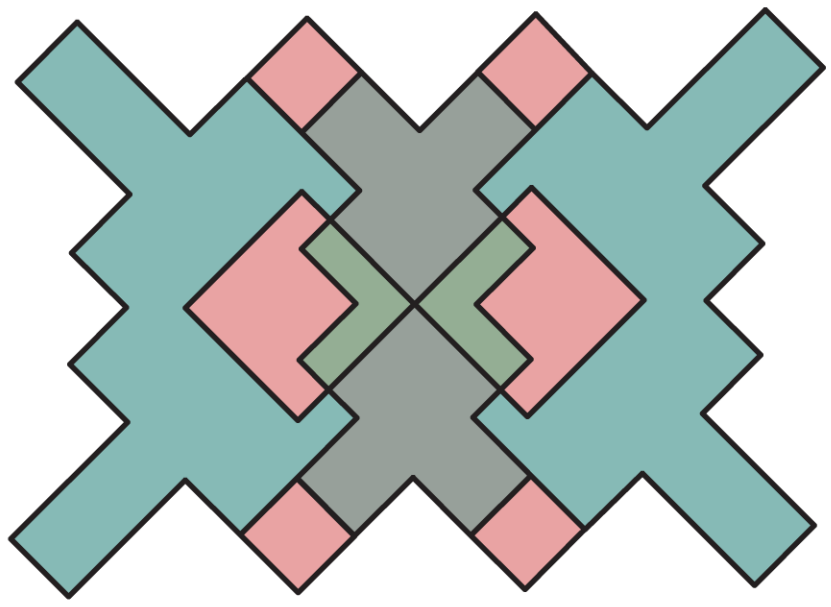

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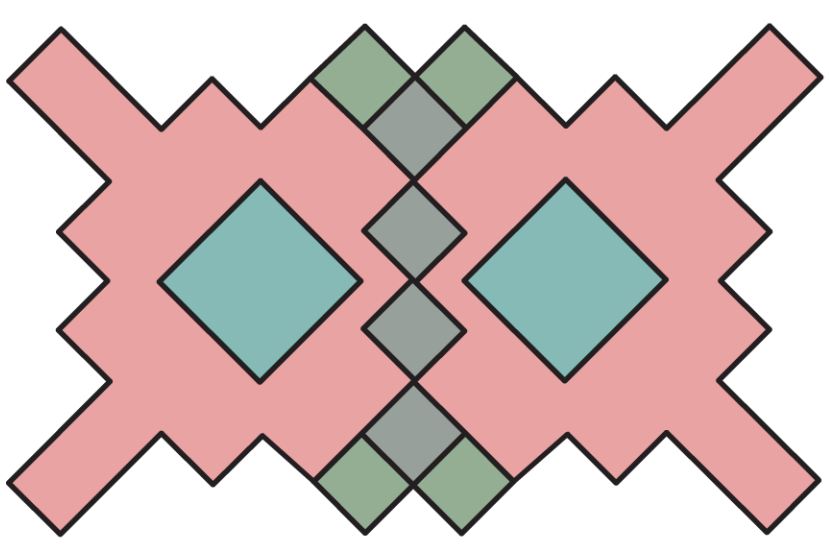

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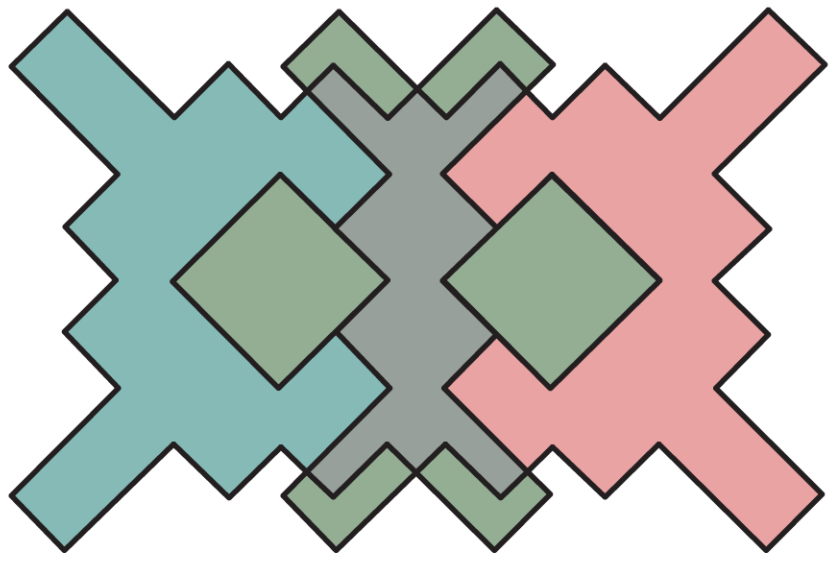

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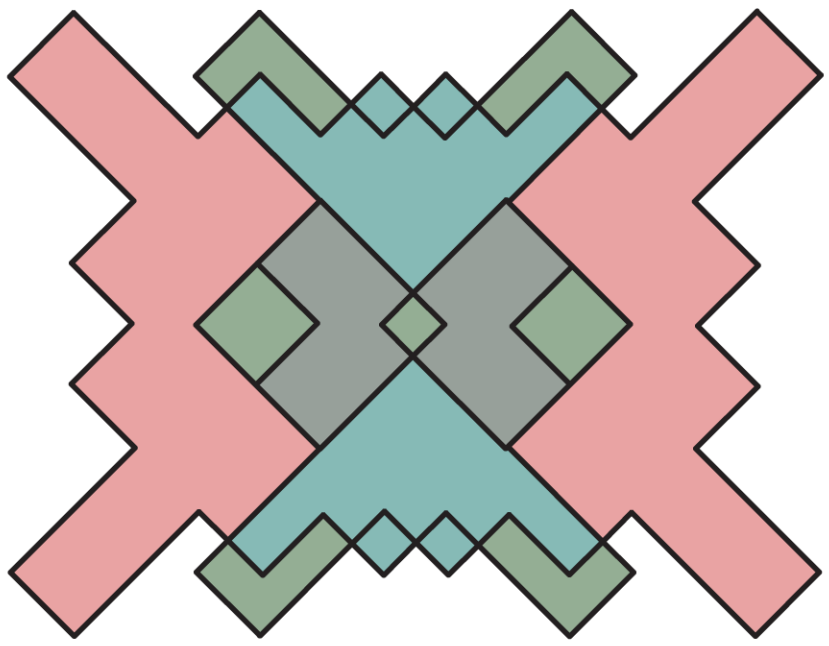

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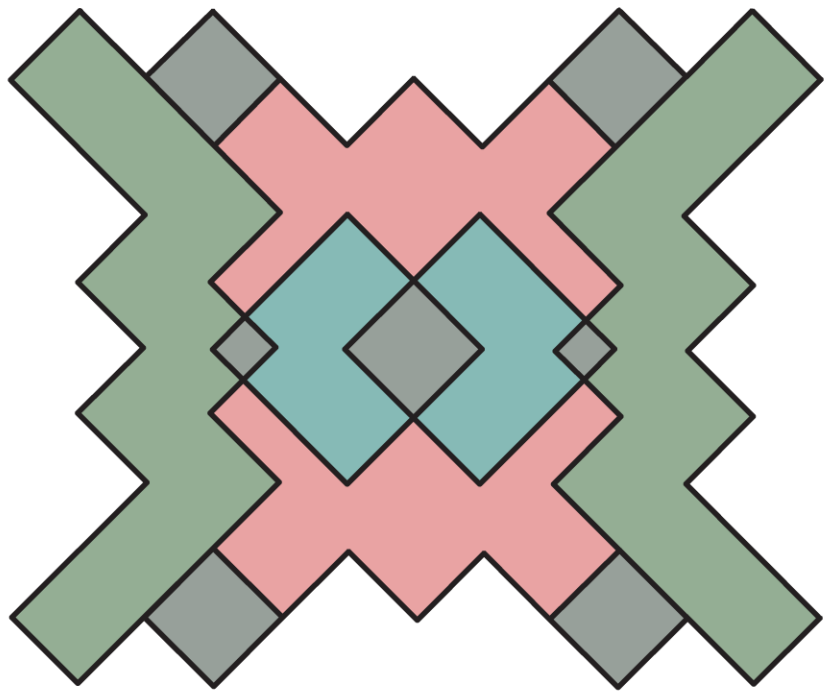

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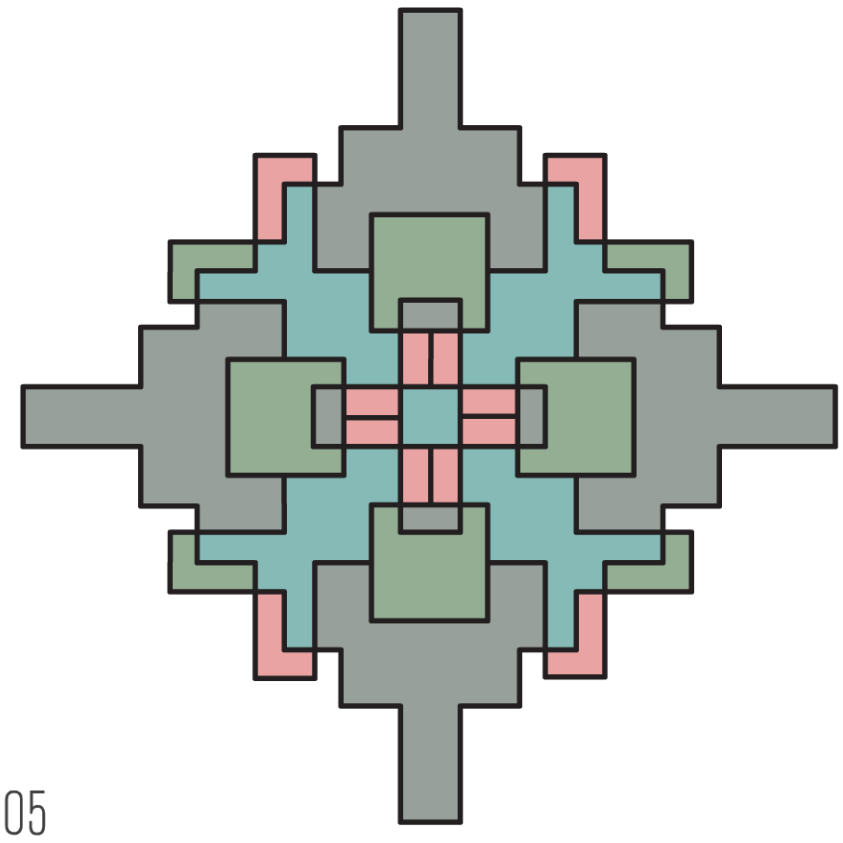

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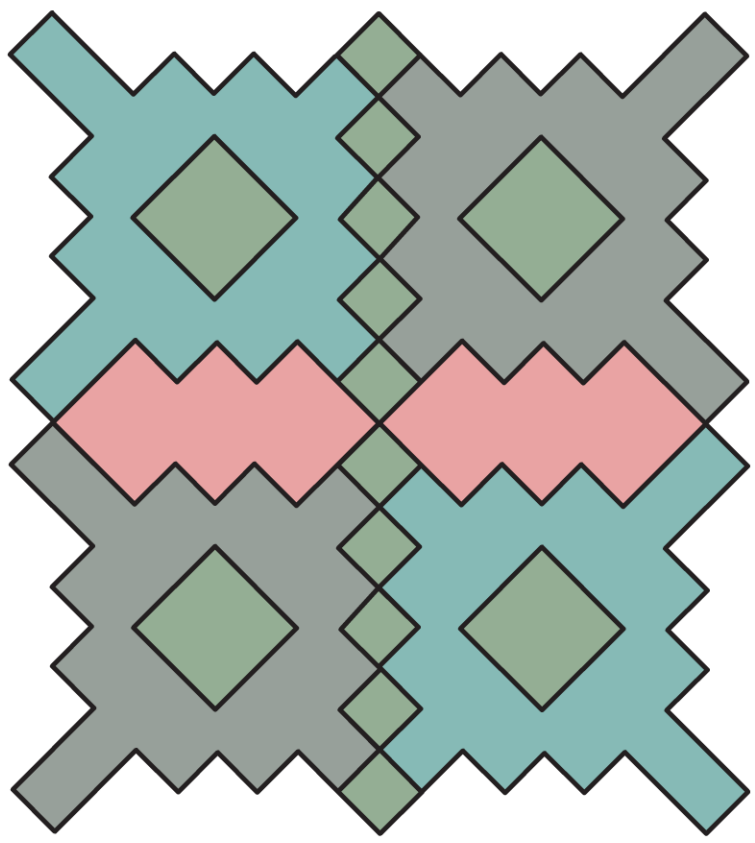

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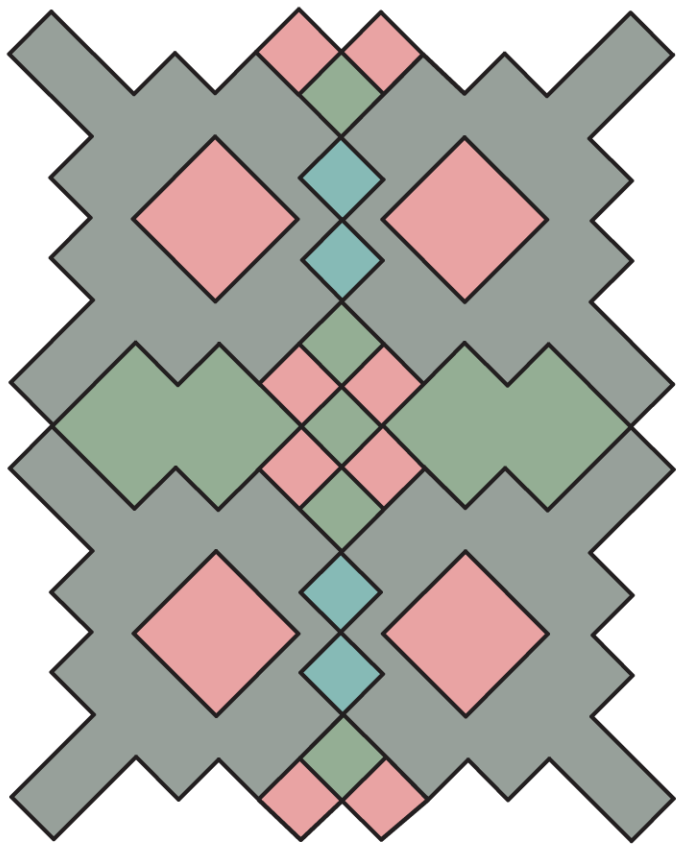

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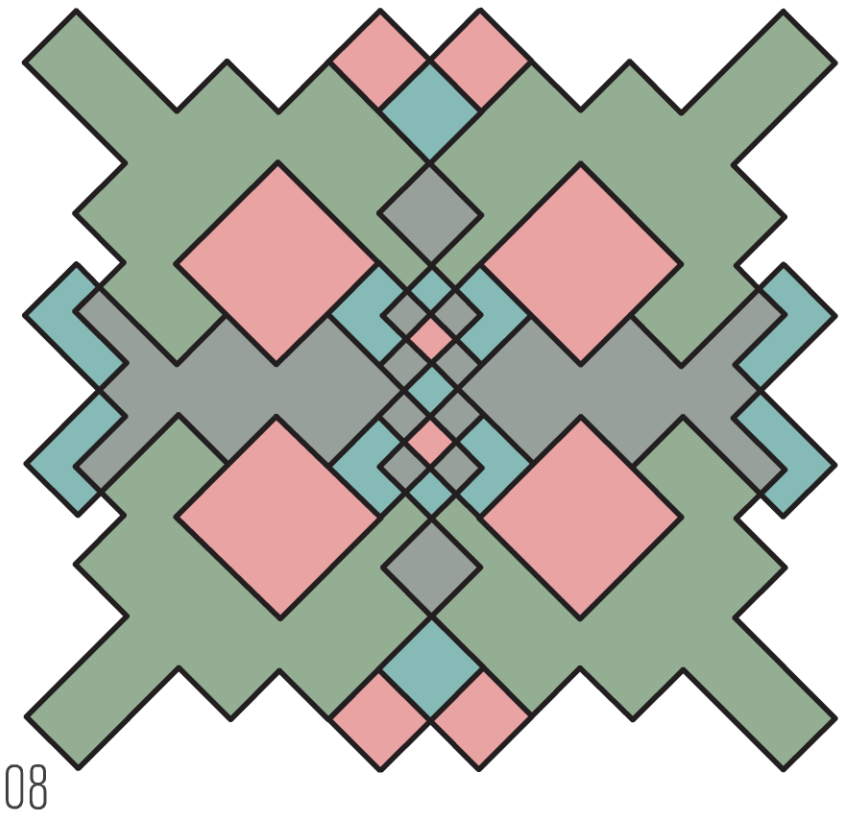

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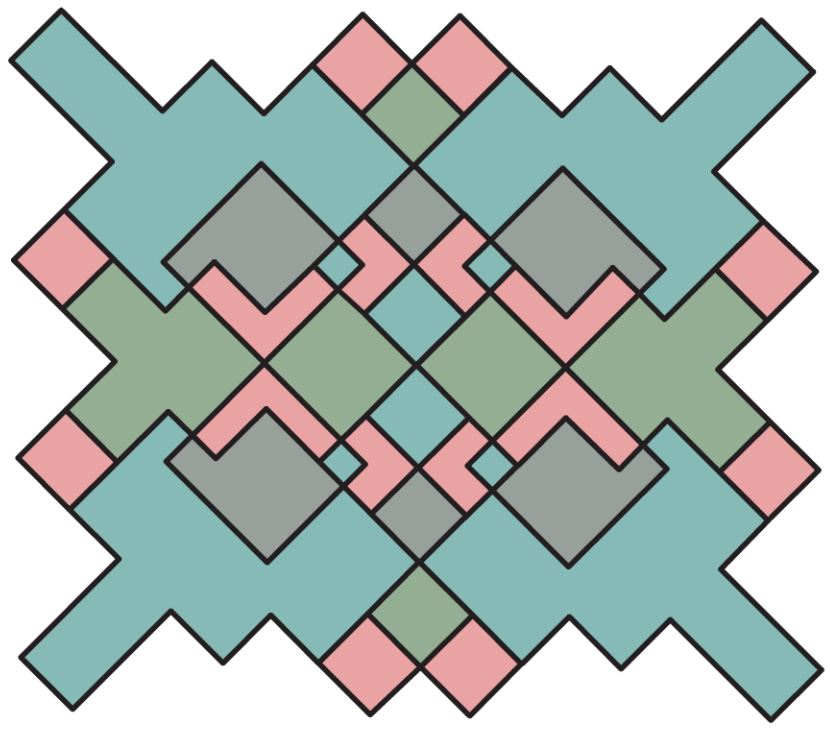

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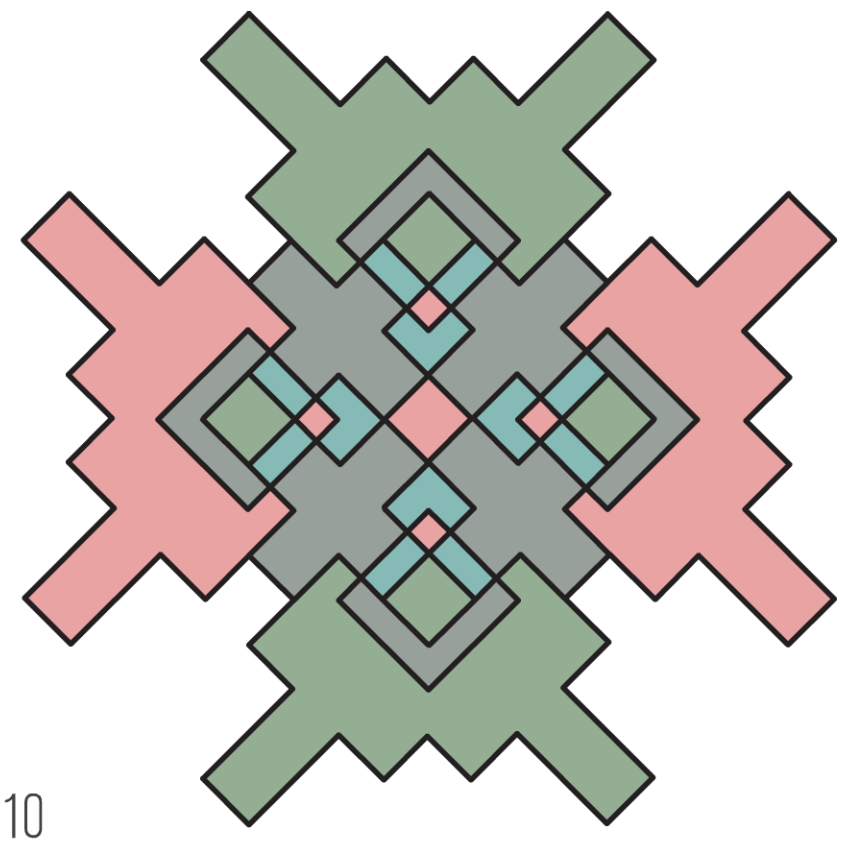

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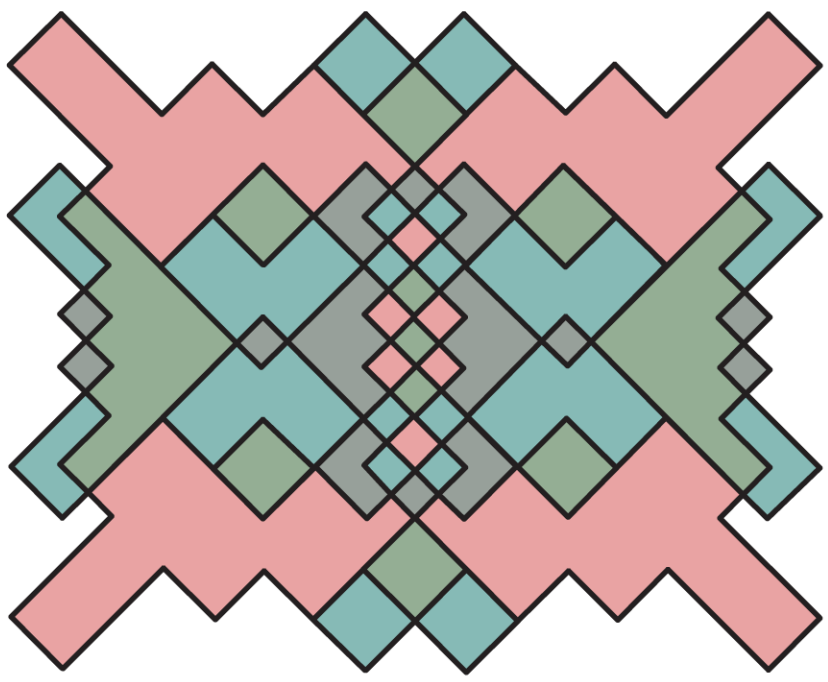

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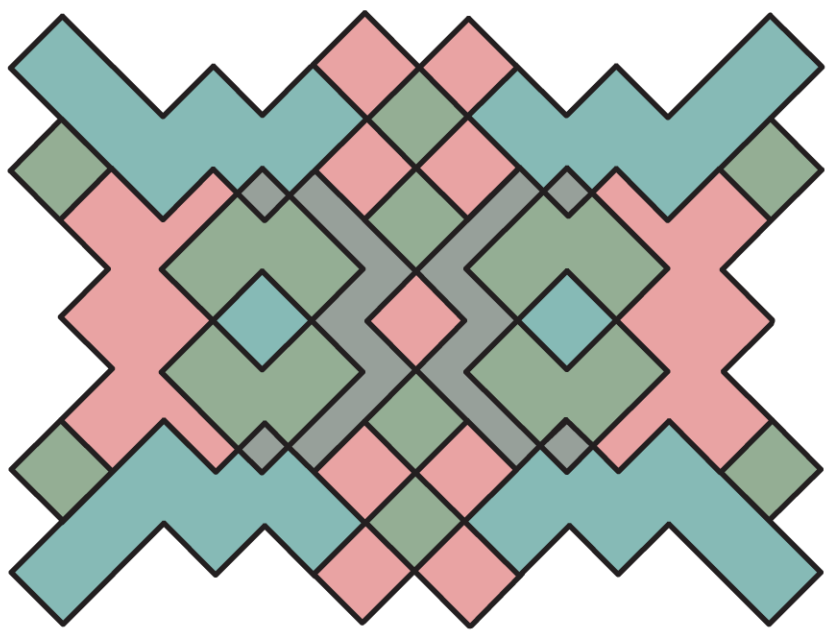

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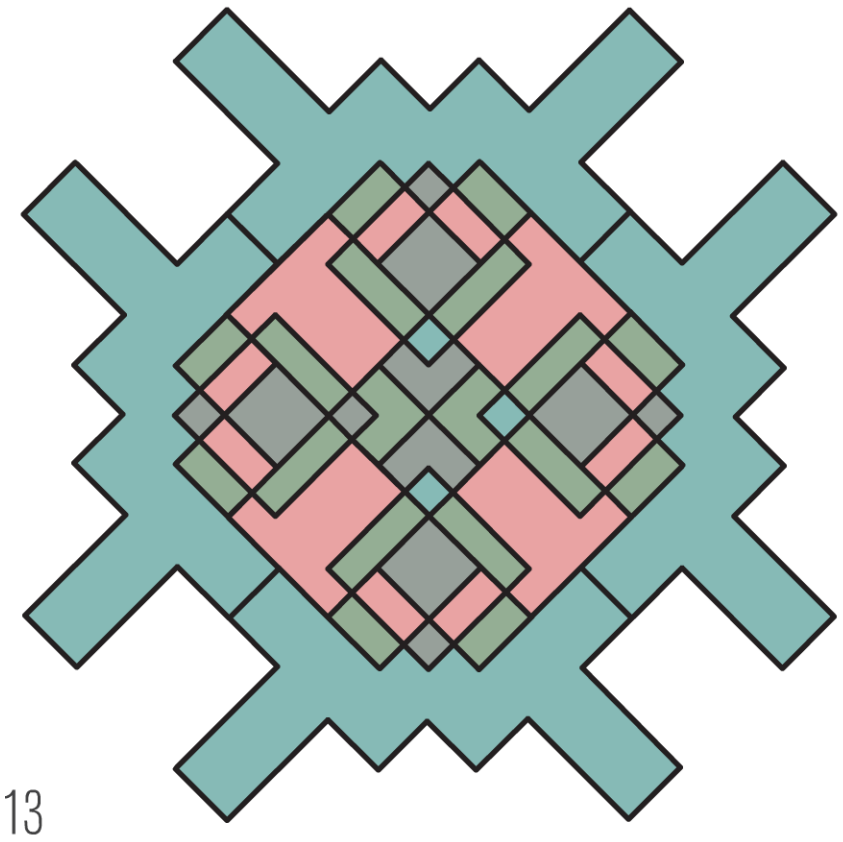

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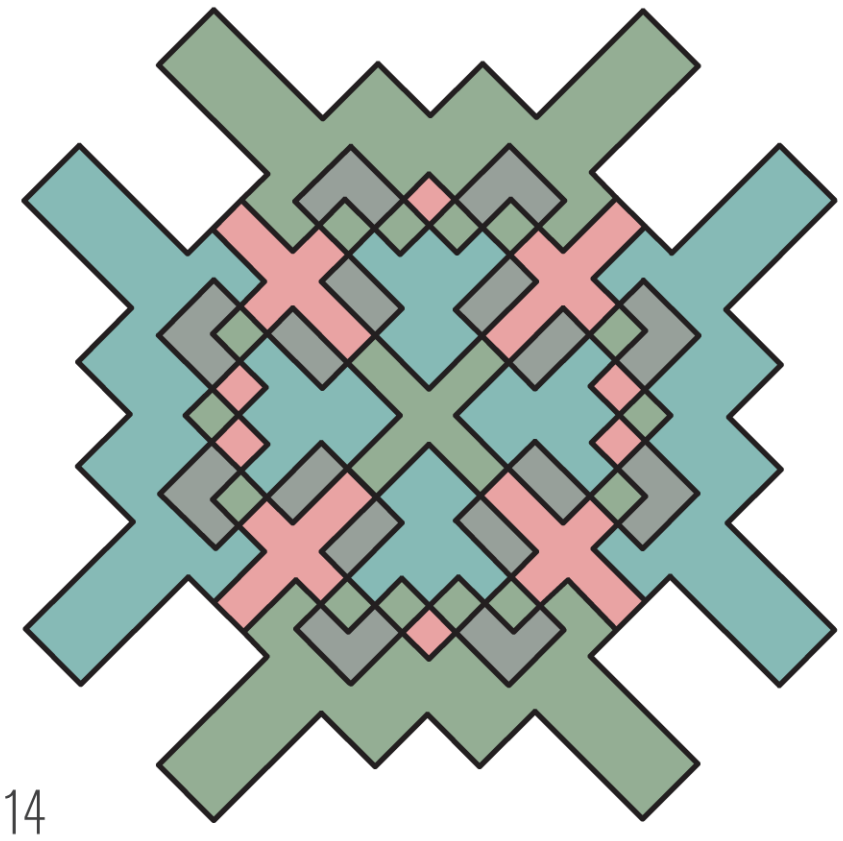

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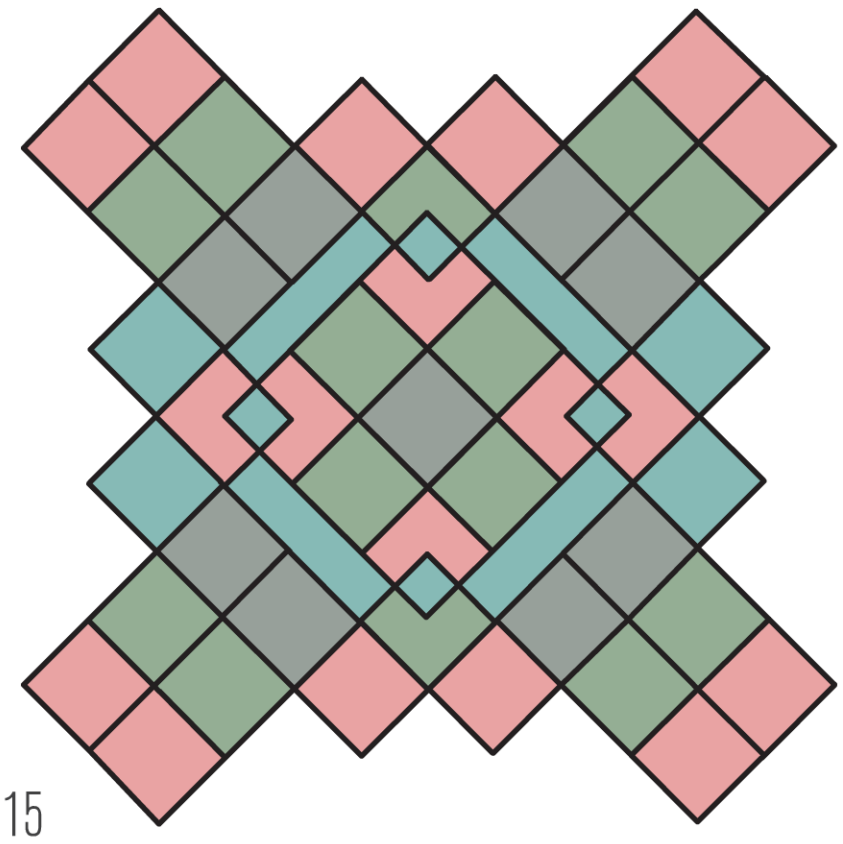

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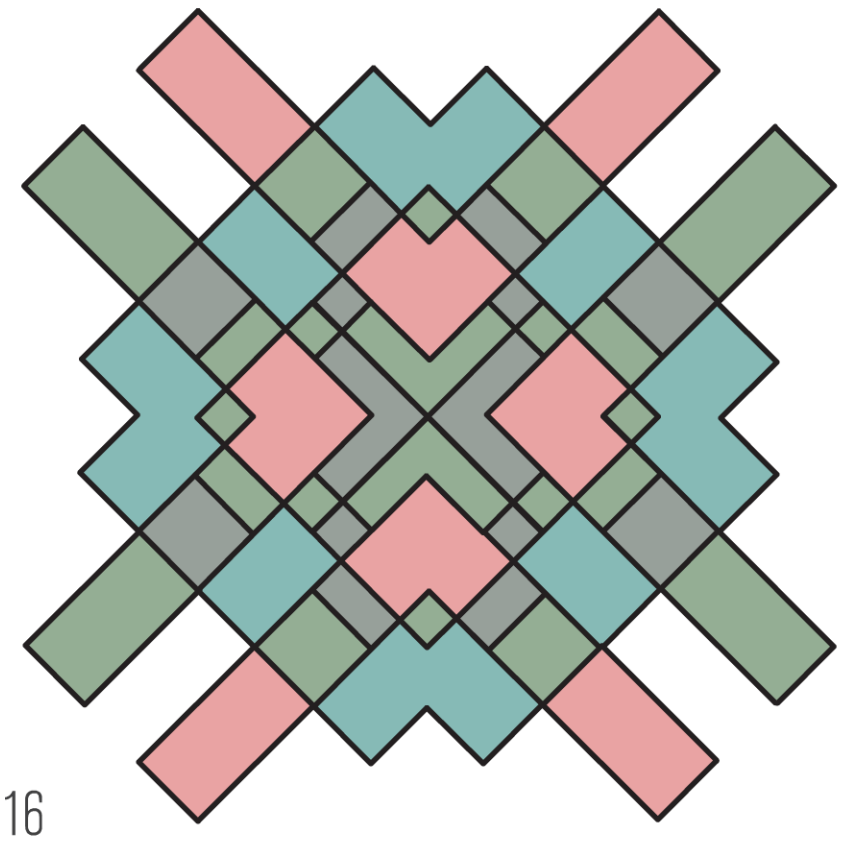

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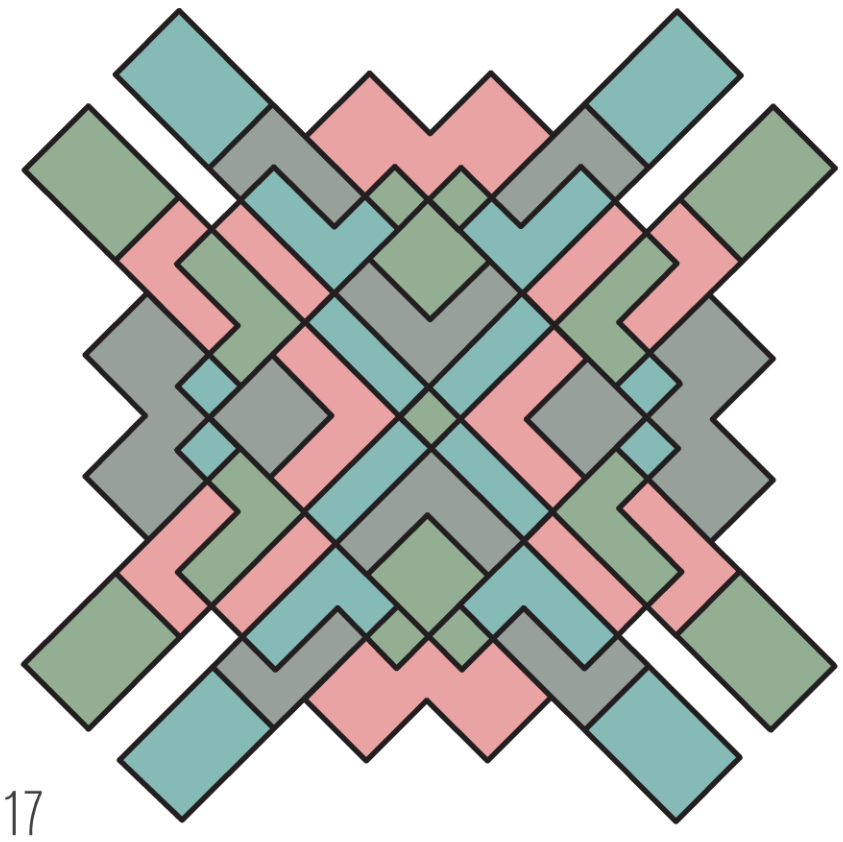

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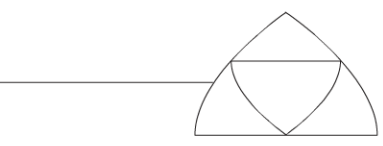
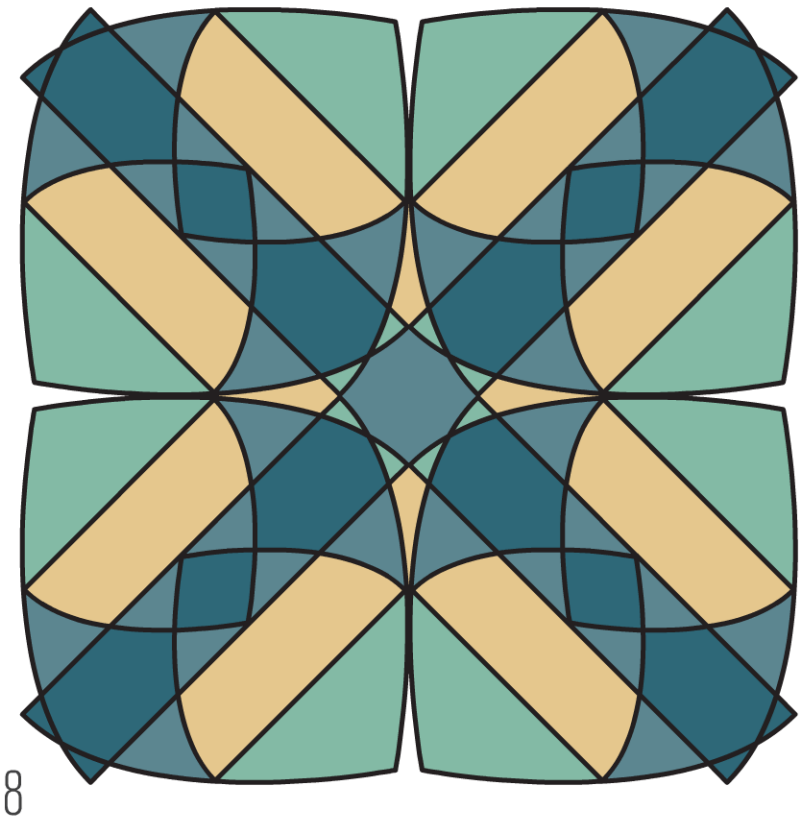


Rounded Triangles



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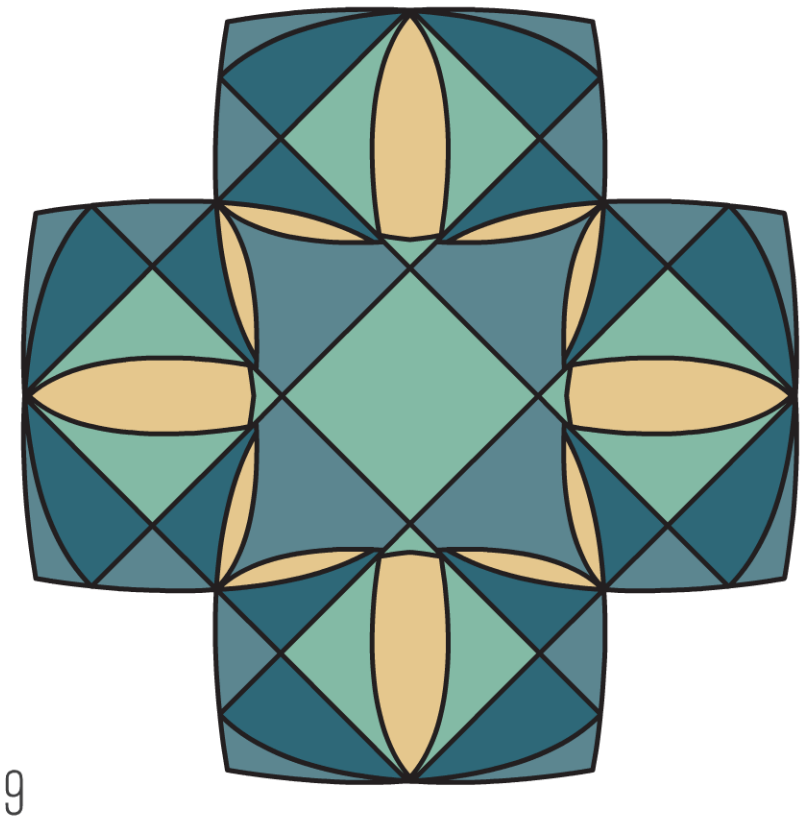

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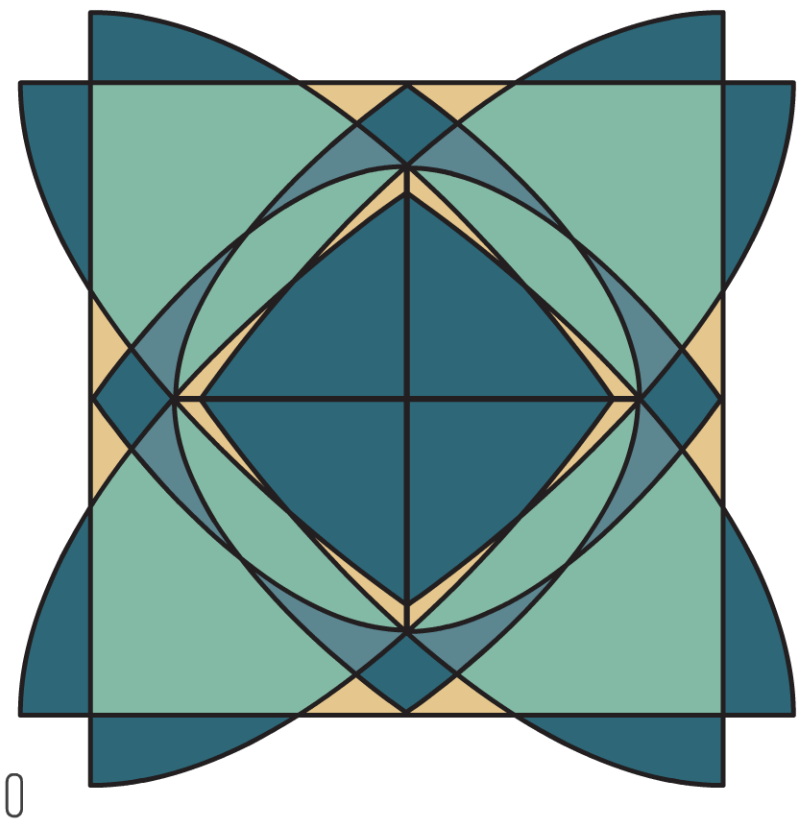

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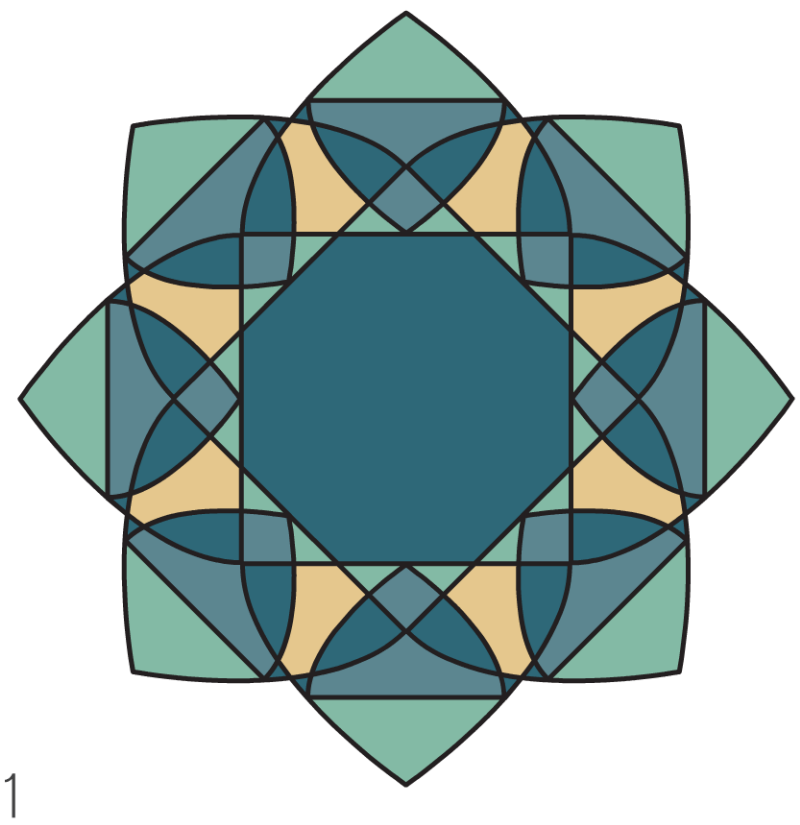

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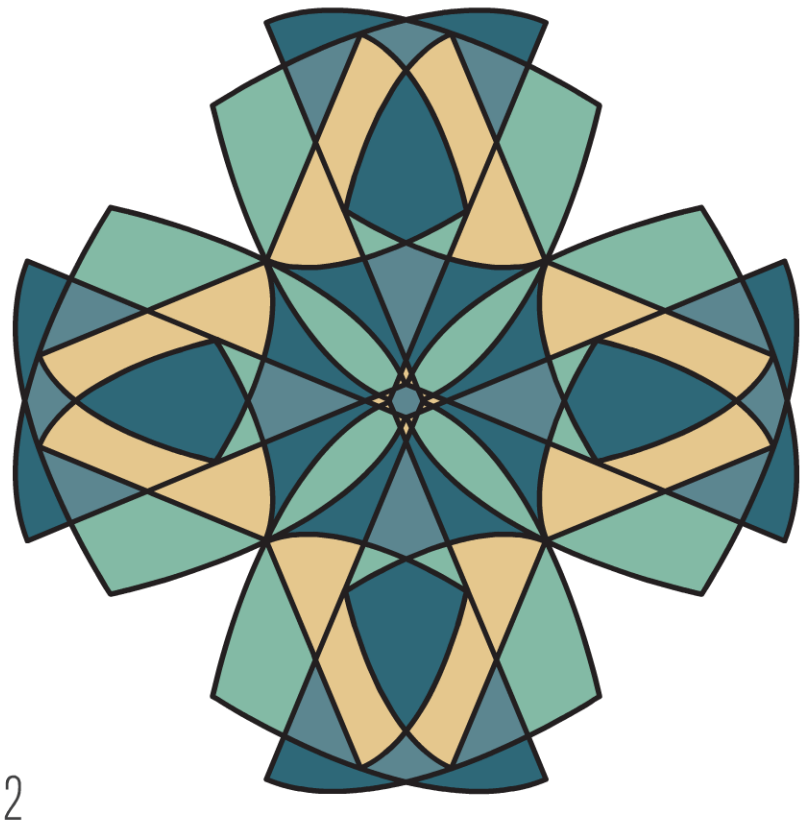

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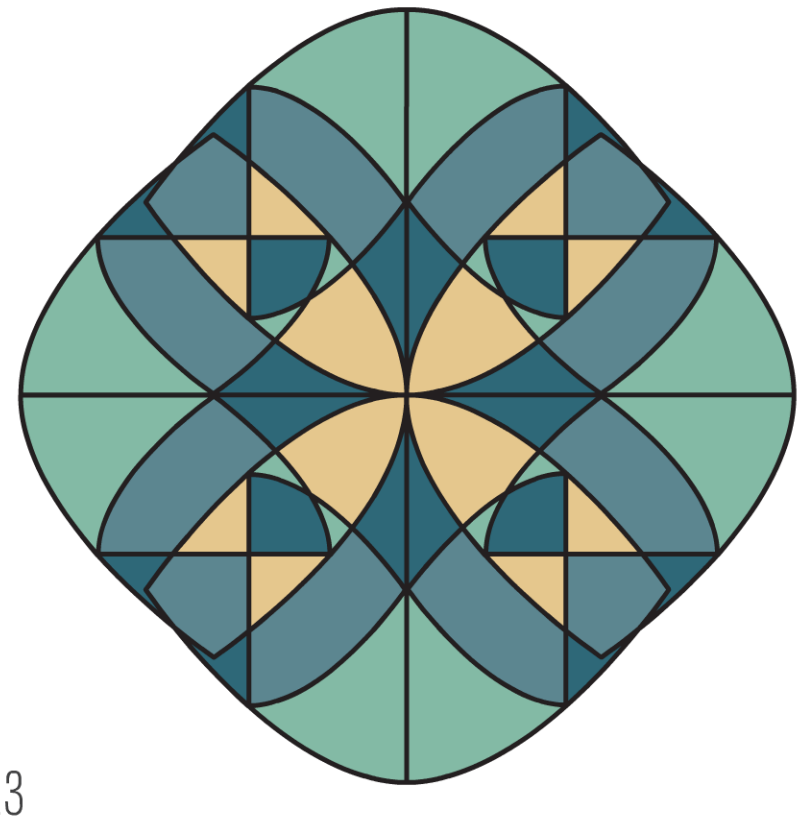

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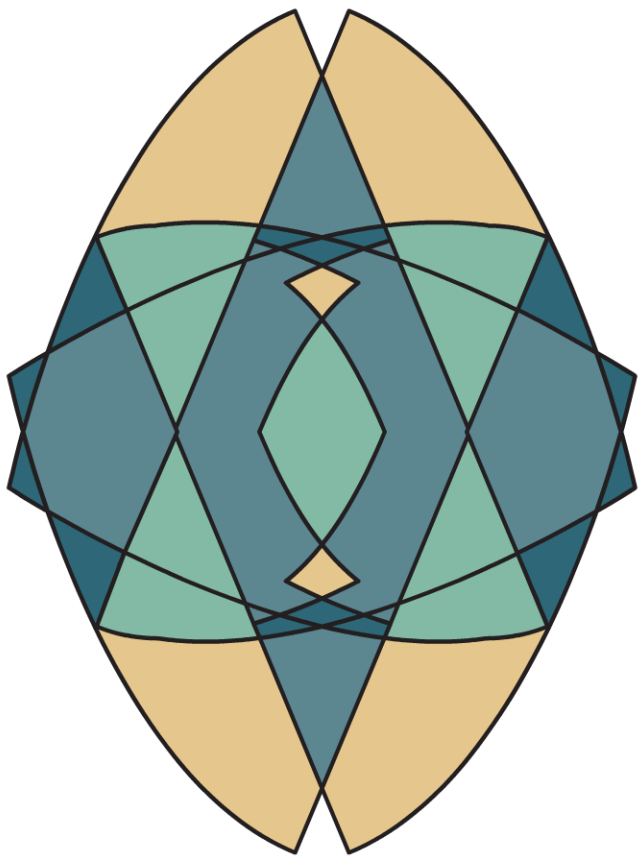

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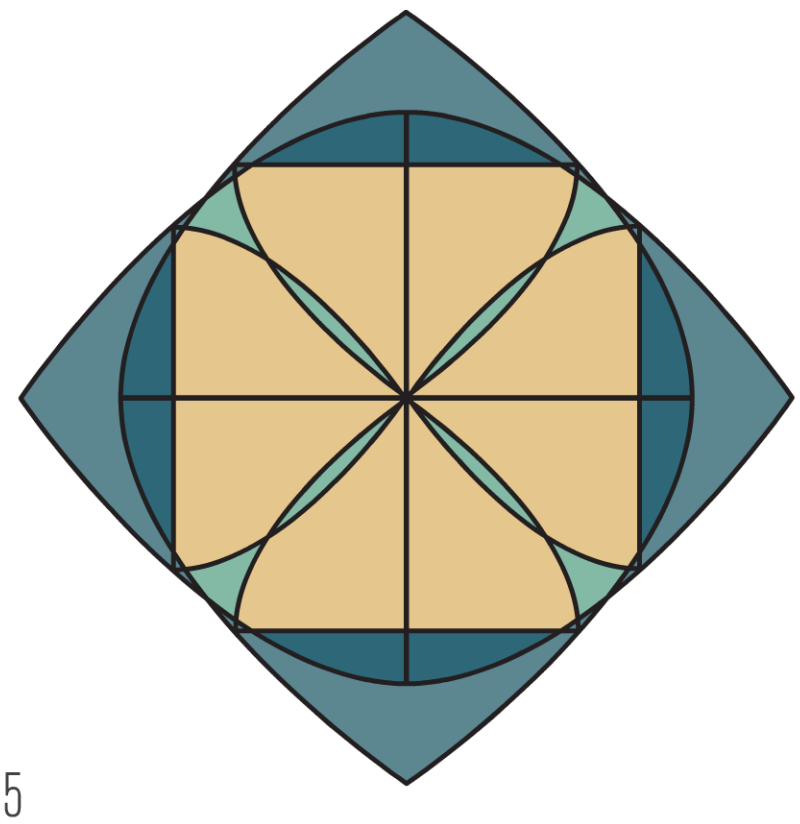

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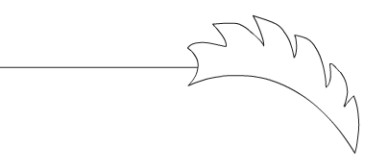
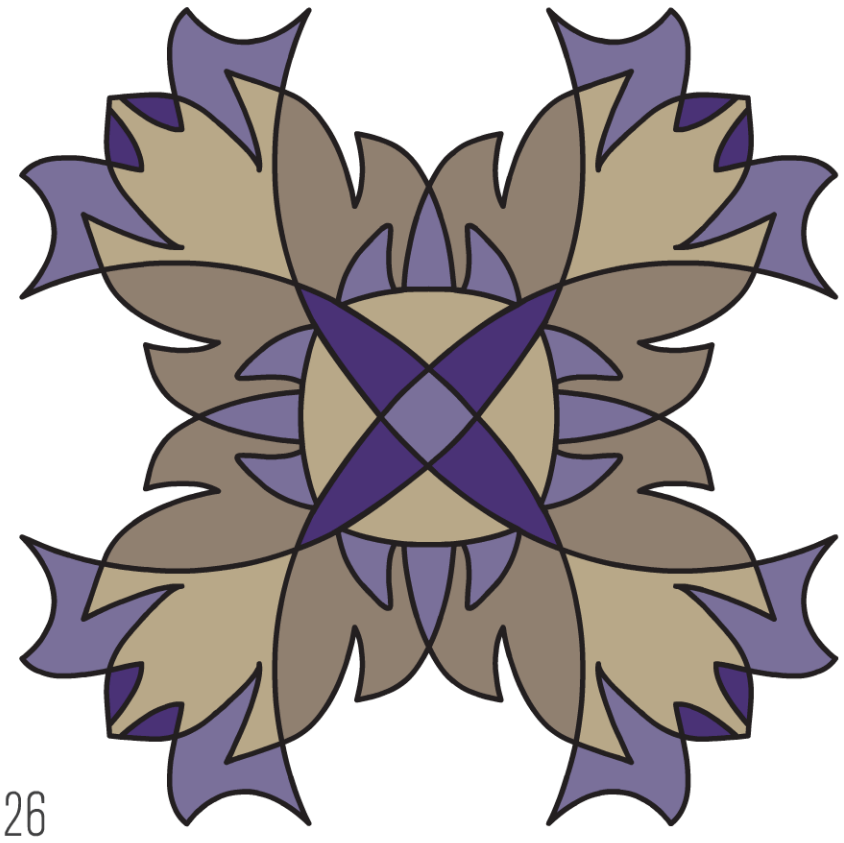


Saw Leaf



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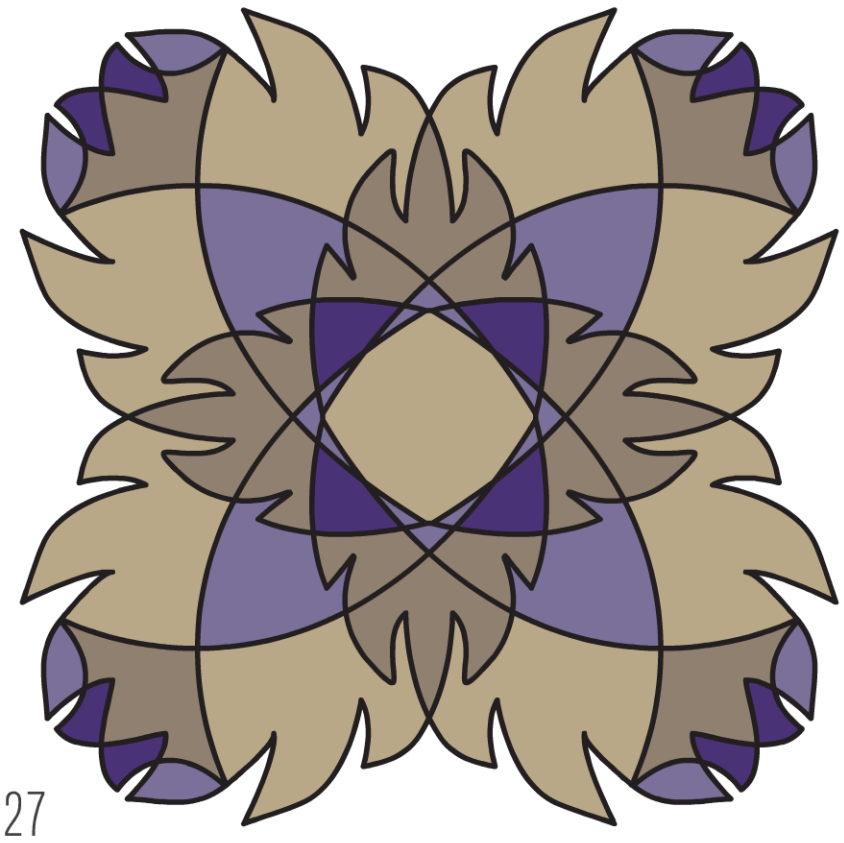

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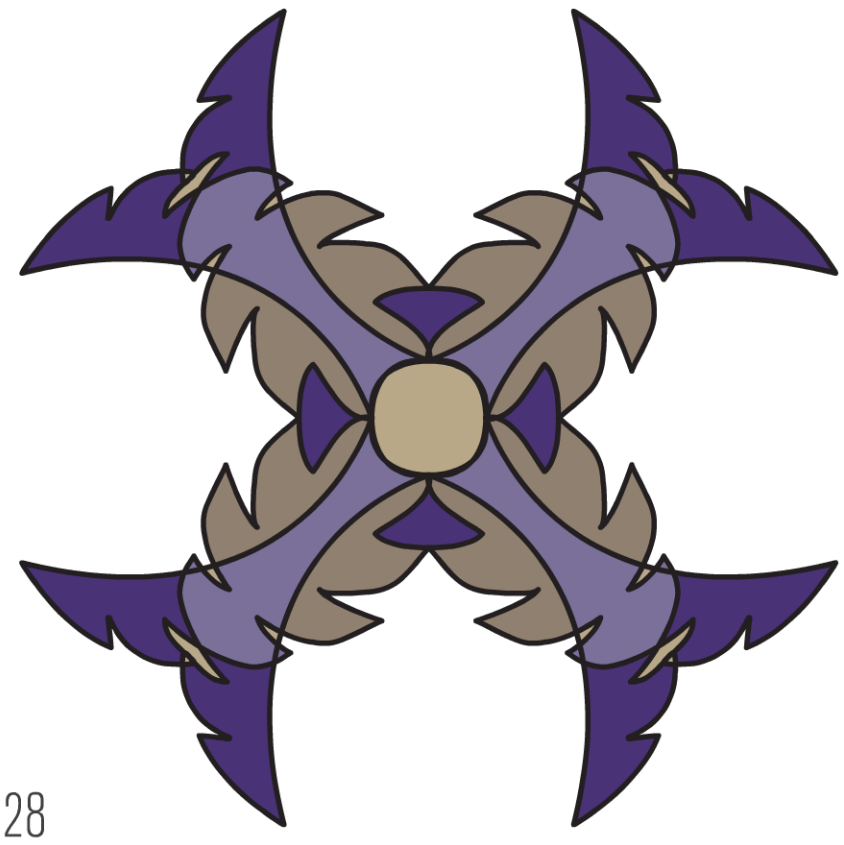

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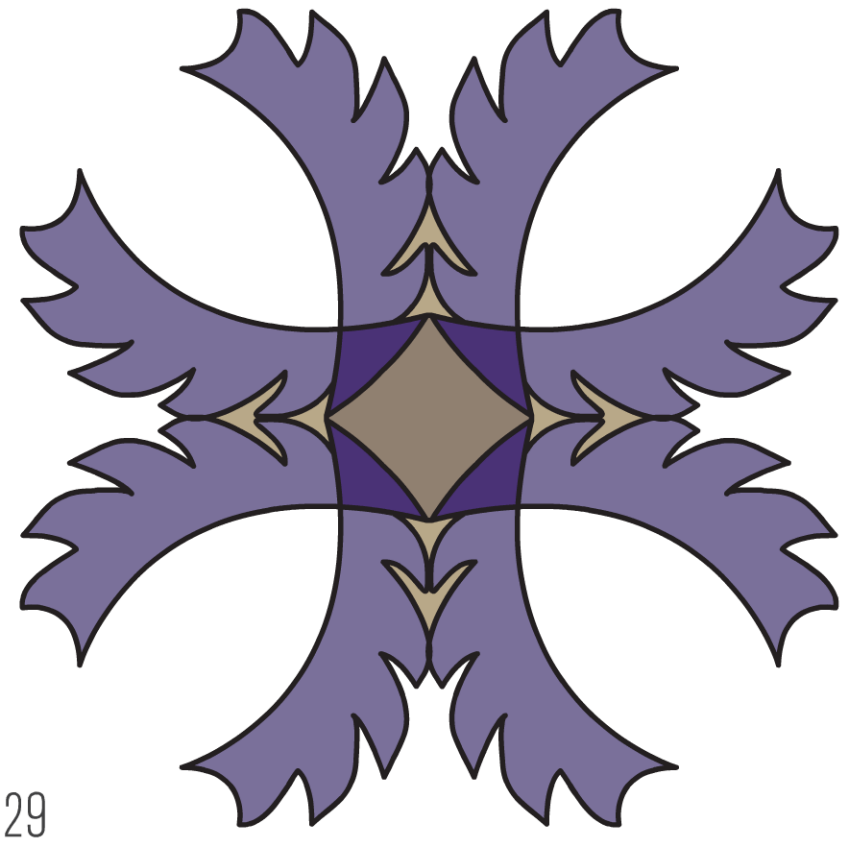

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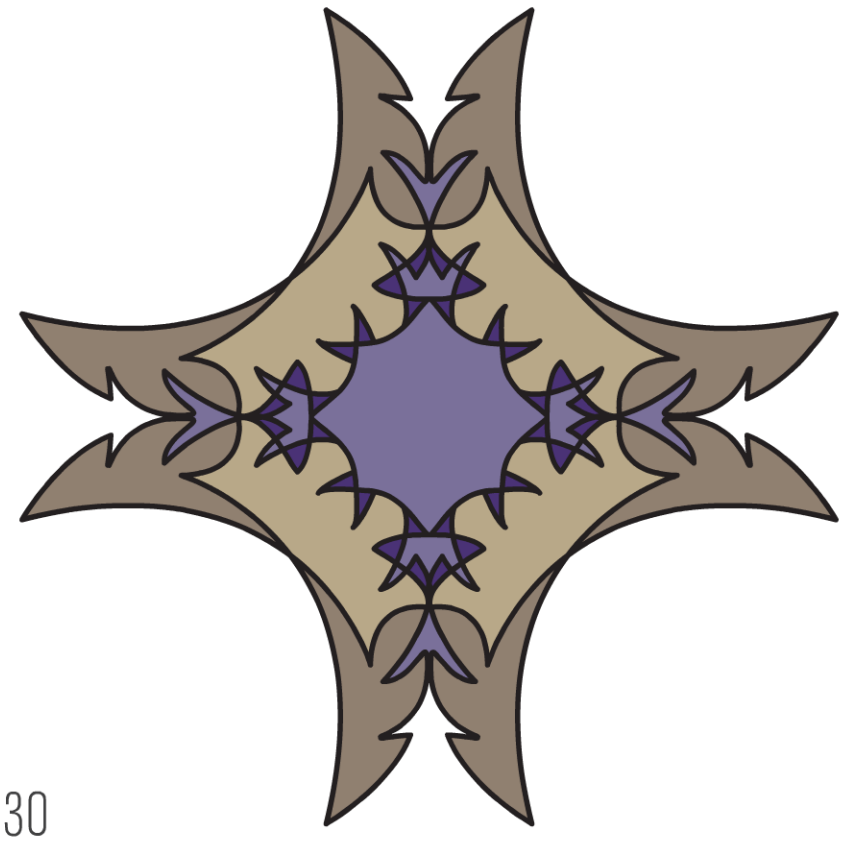

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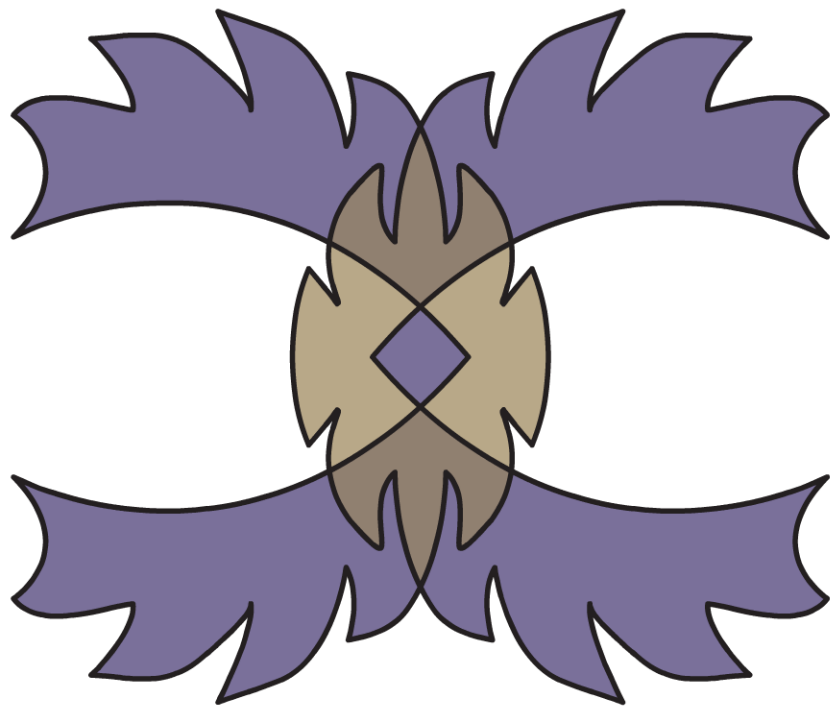

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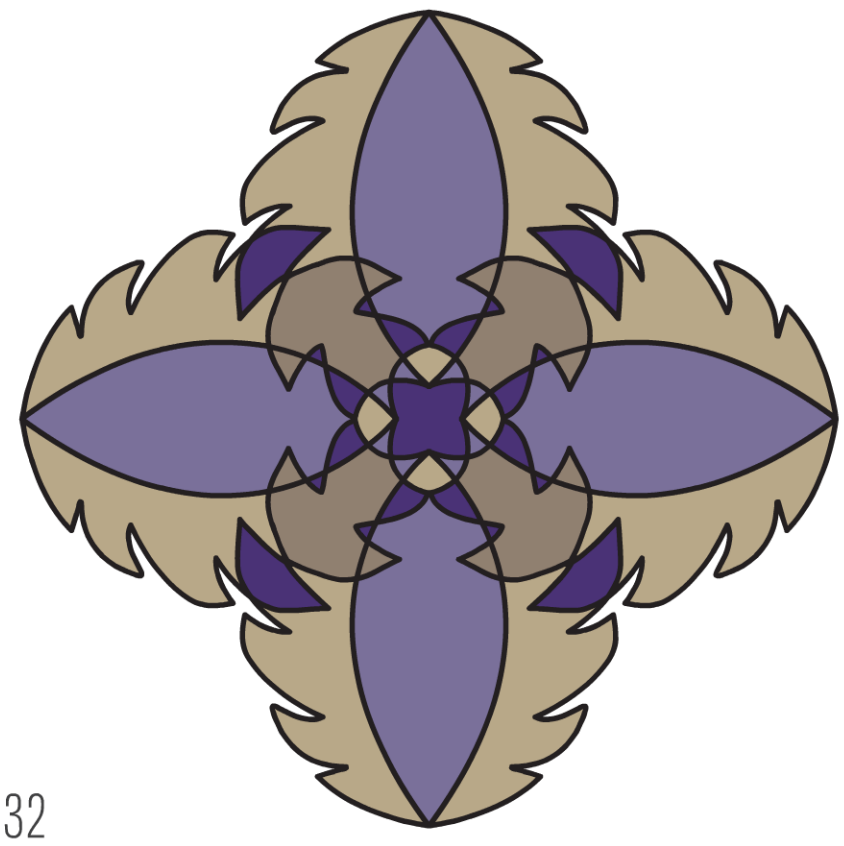

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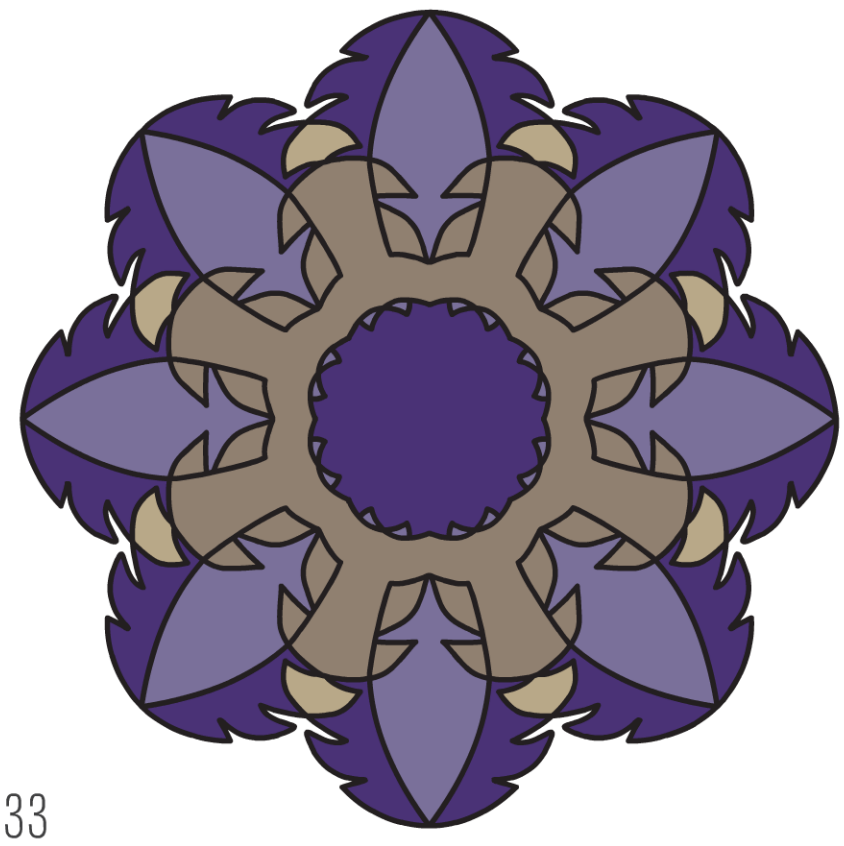

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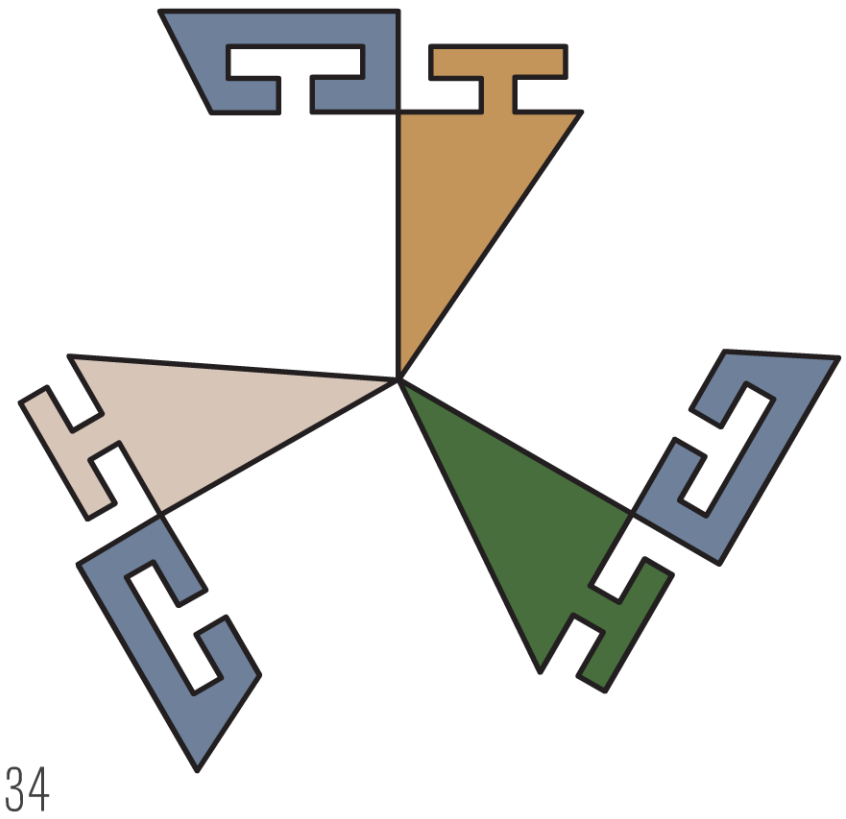
Shield Patterns



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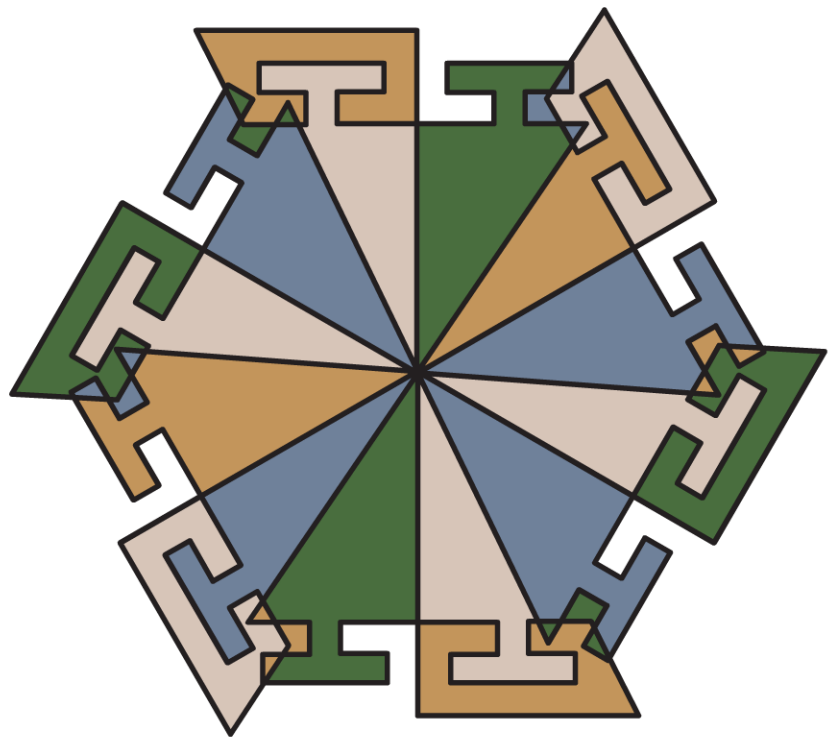

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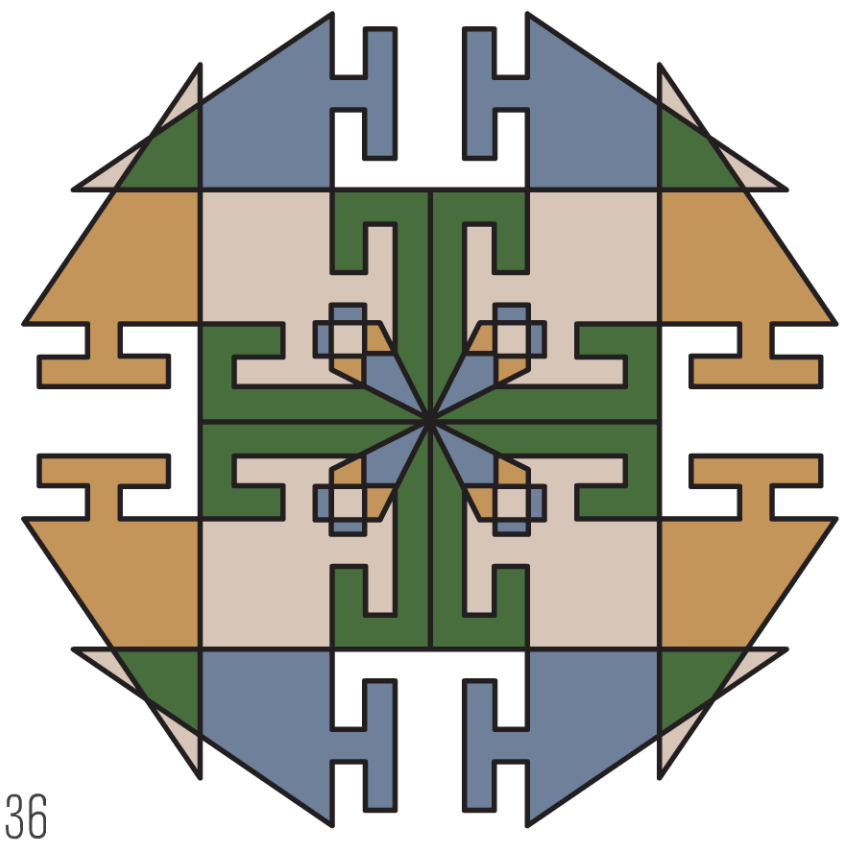

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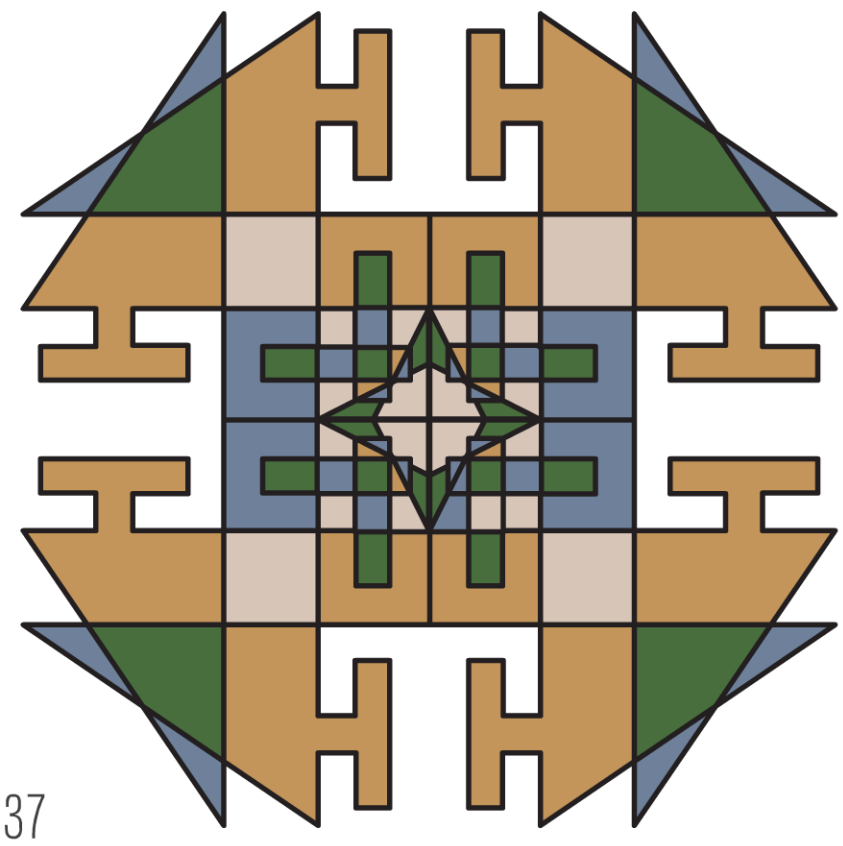

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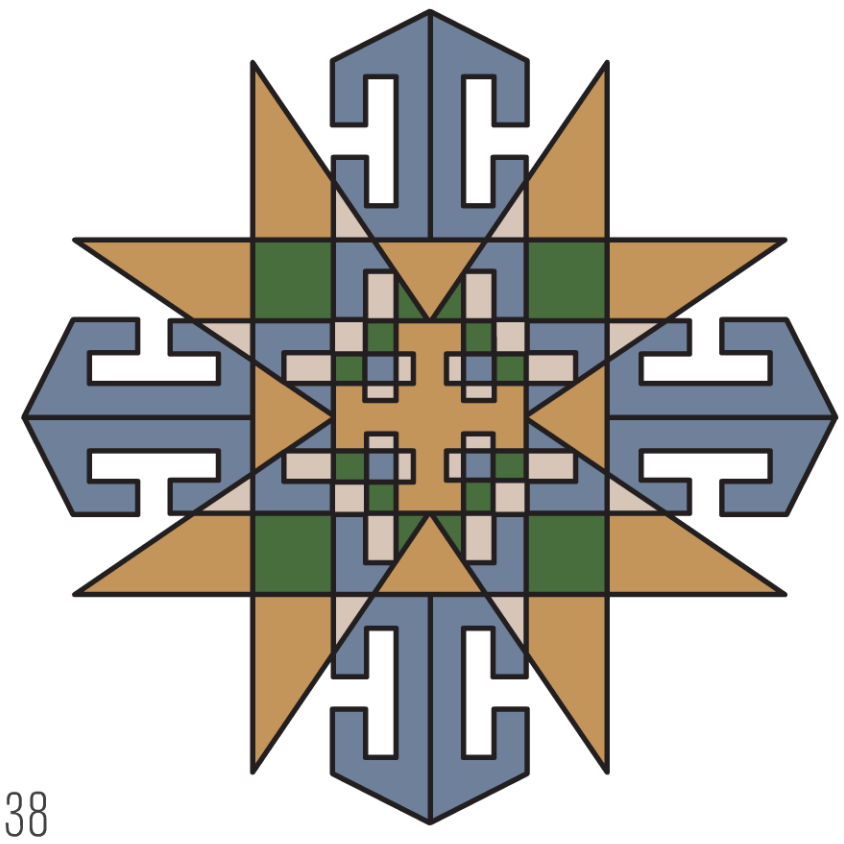

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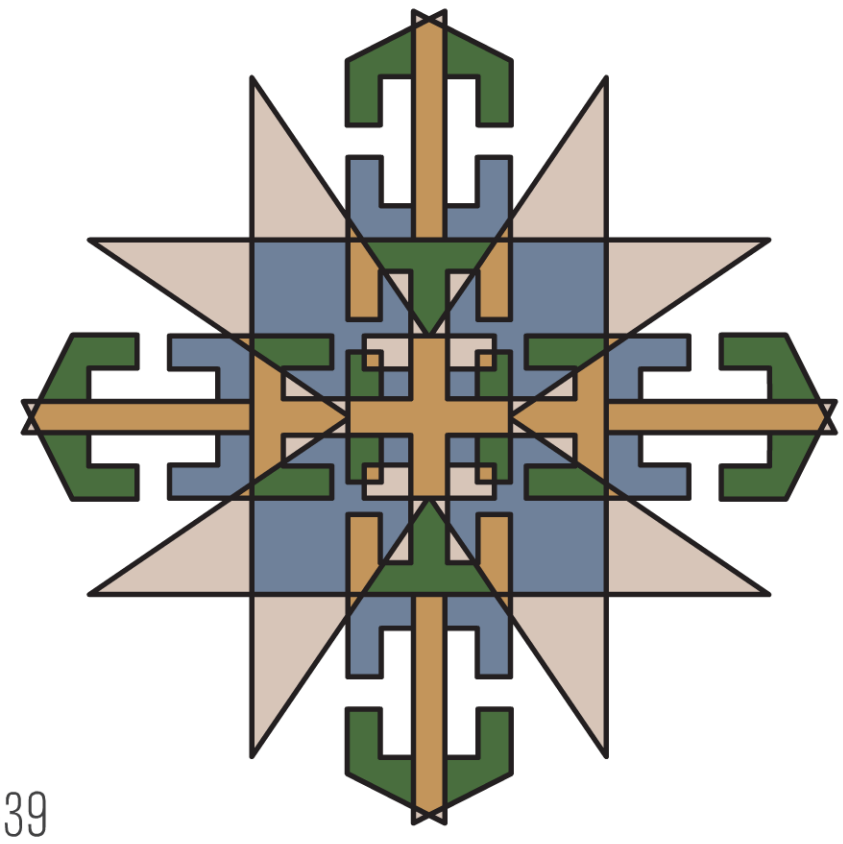

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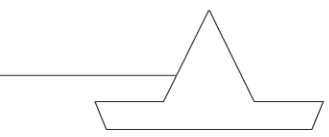
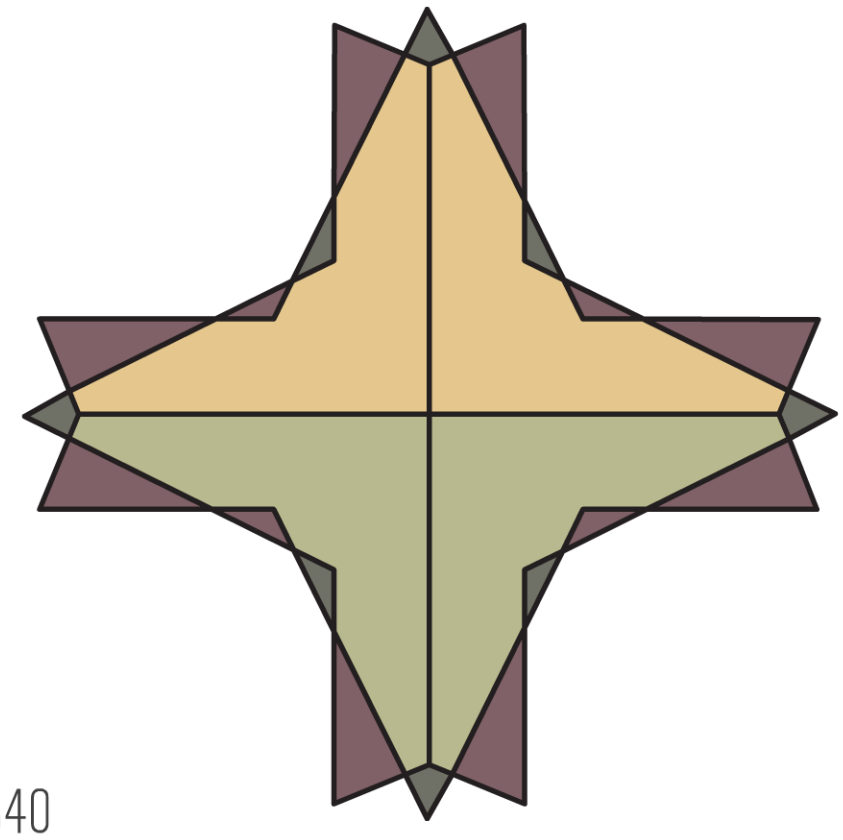


Sombrero



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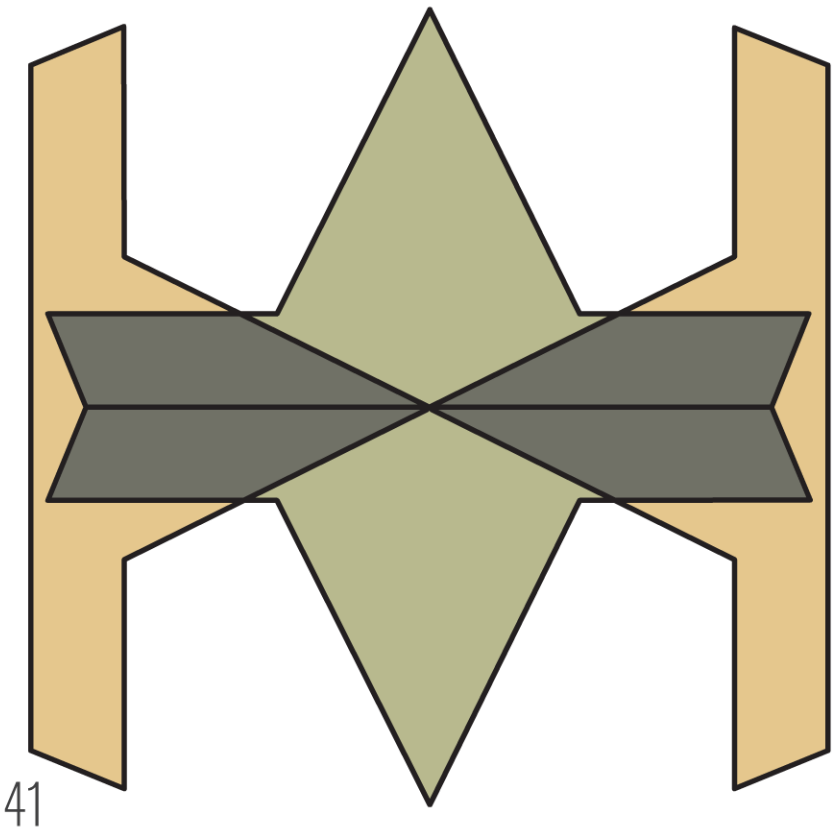

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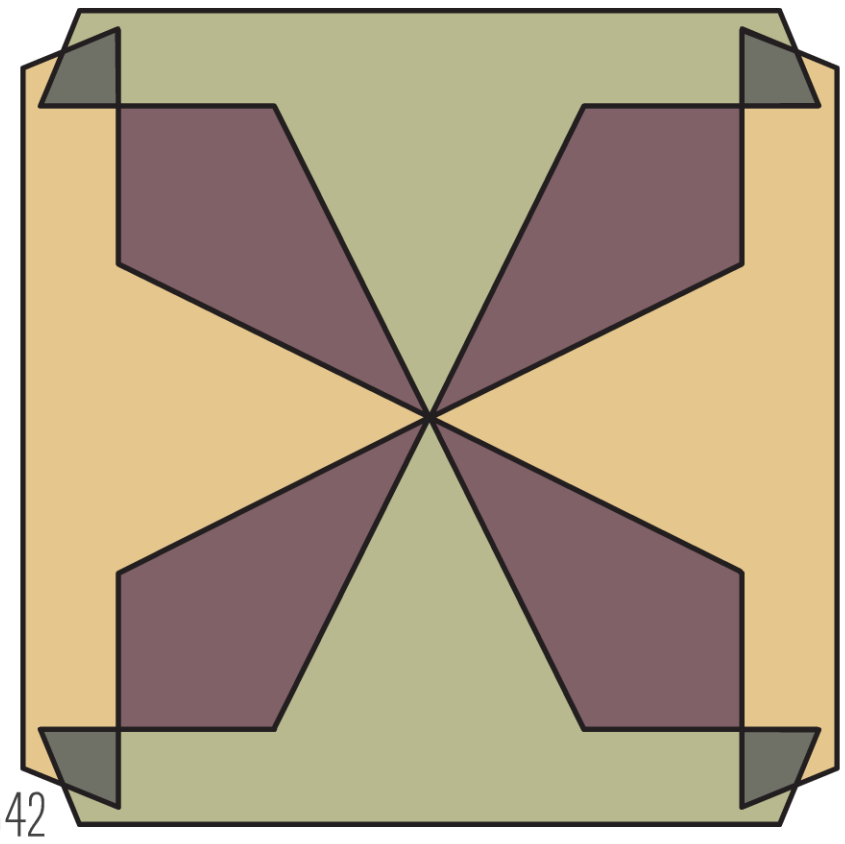

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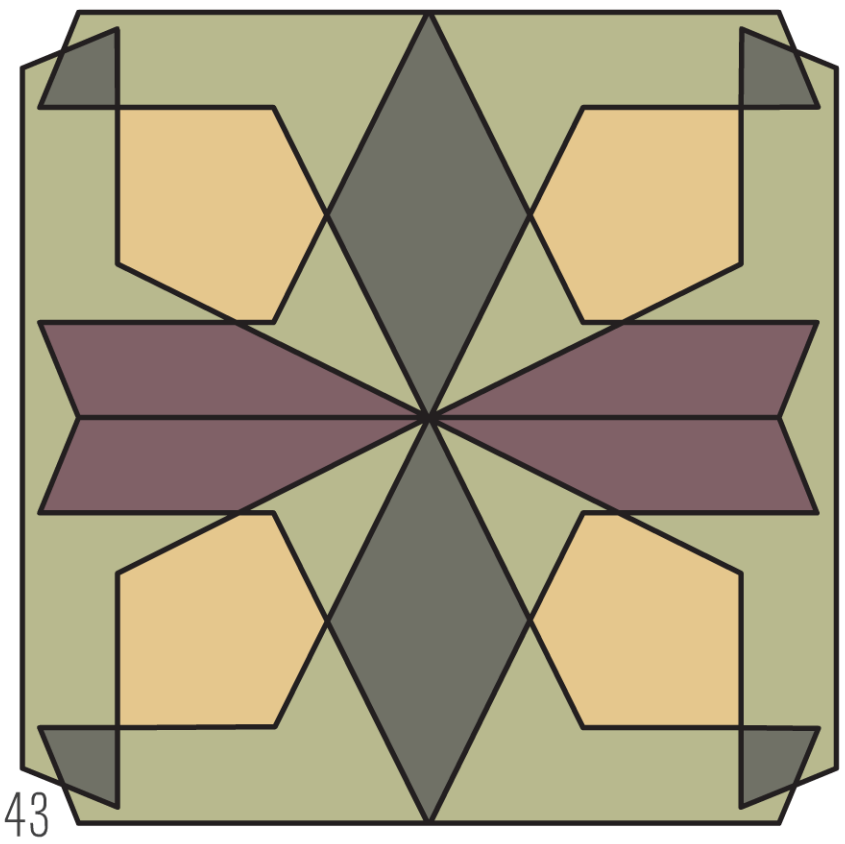

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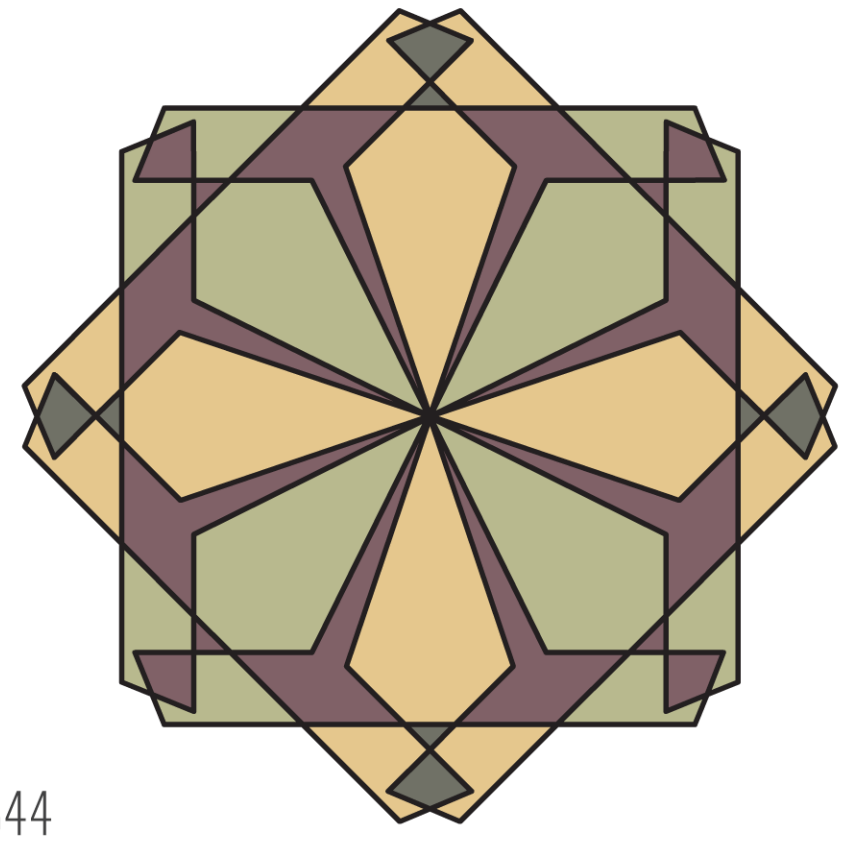

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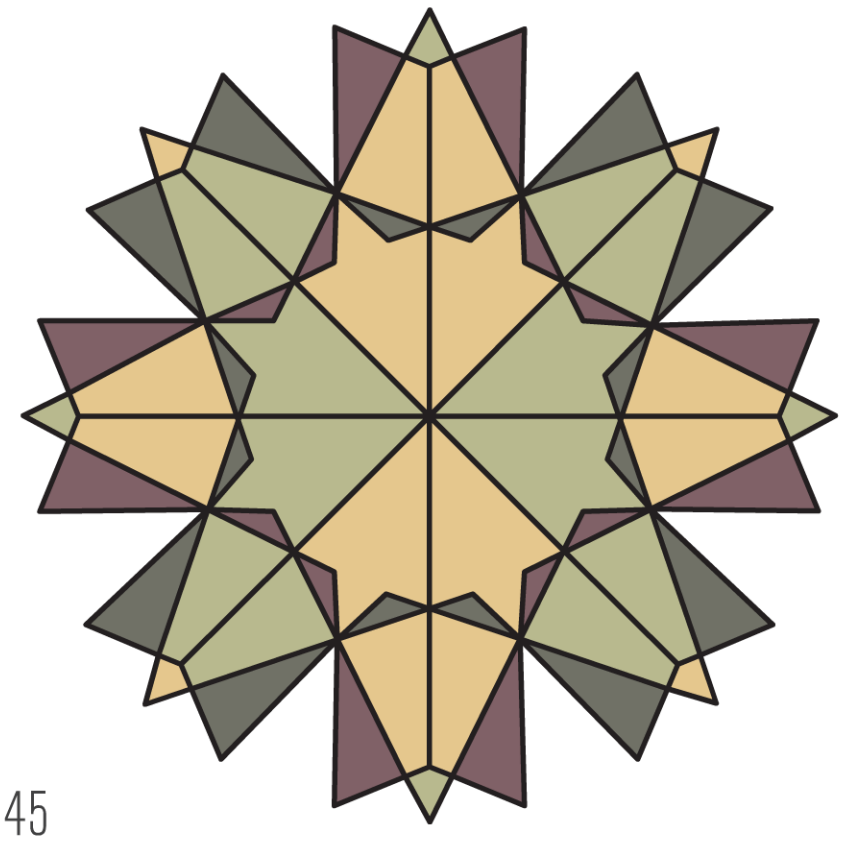

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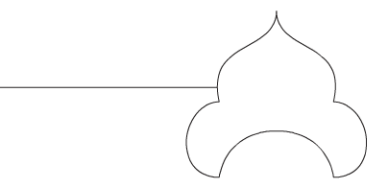

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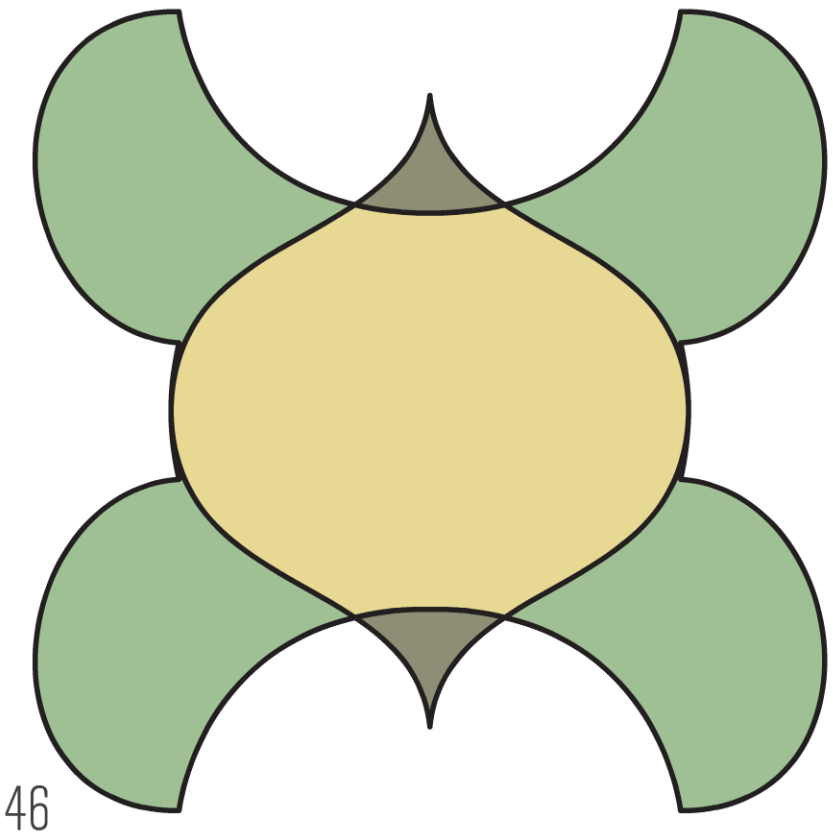

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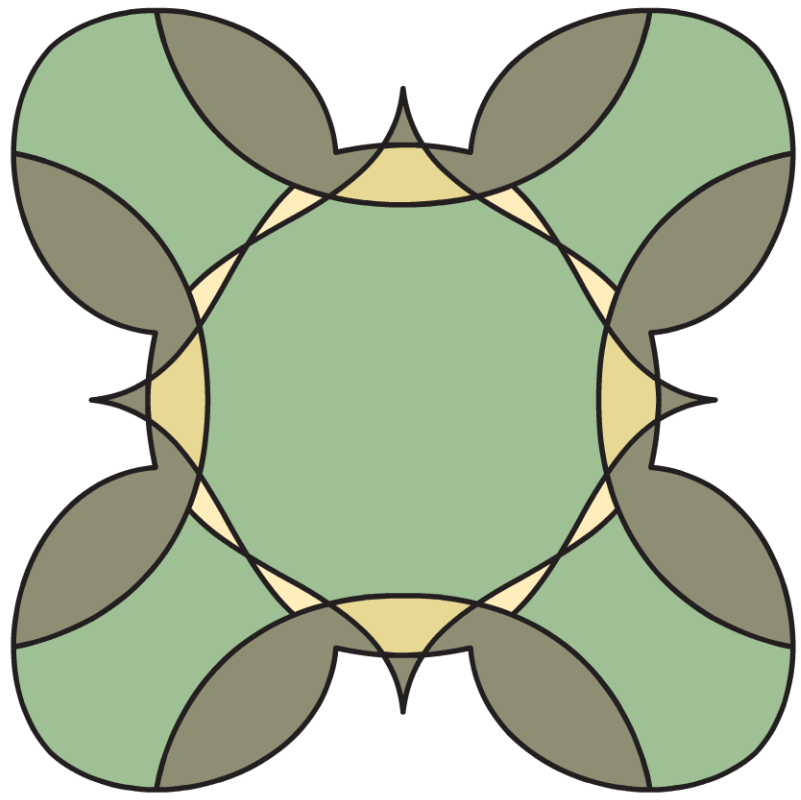

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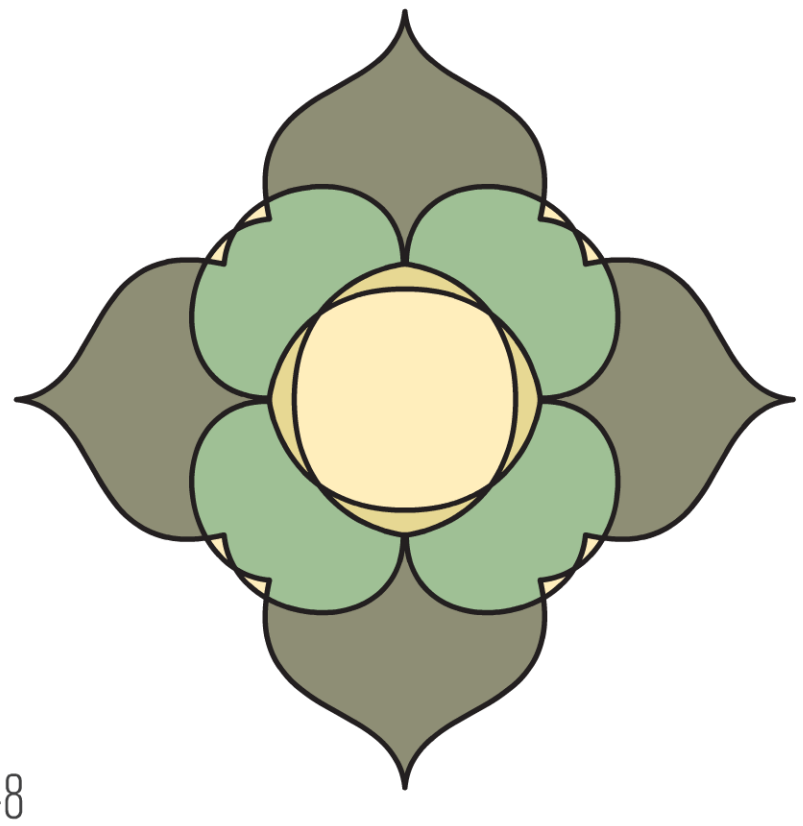

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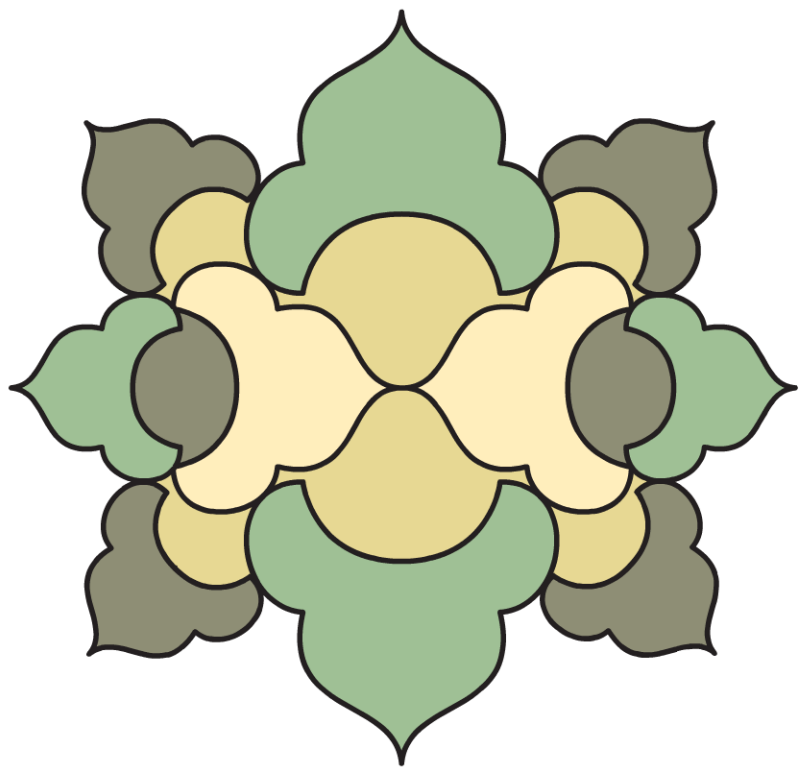

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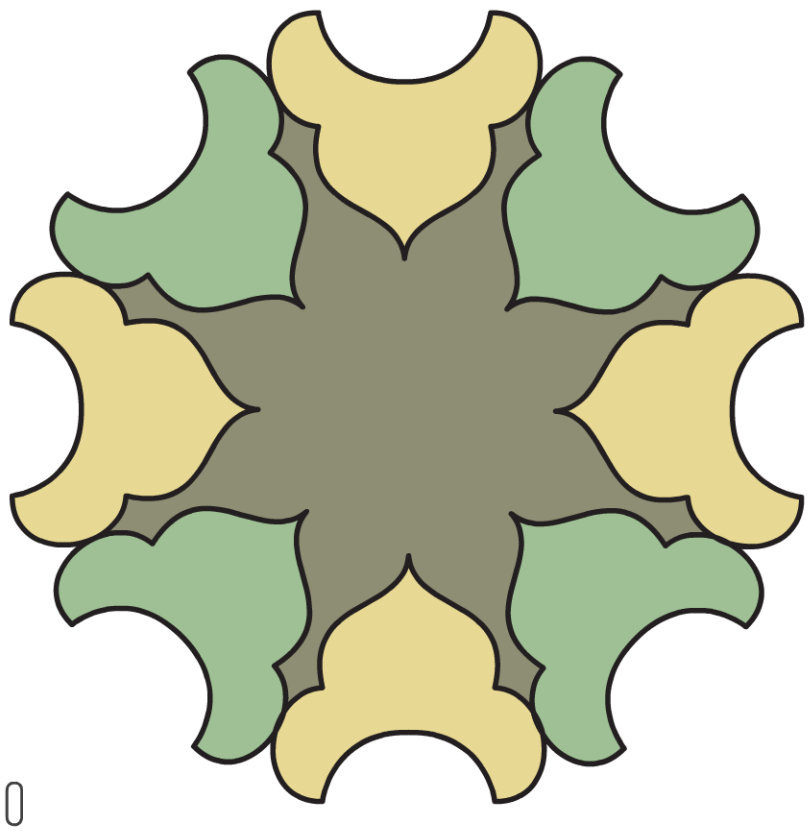

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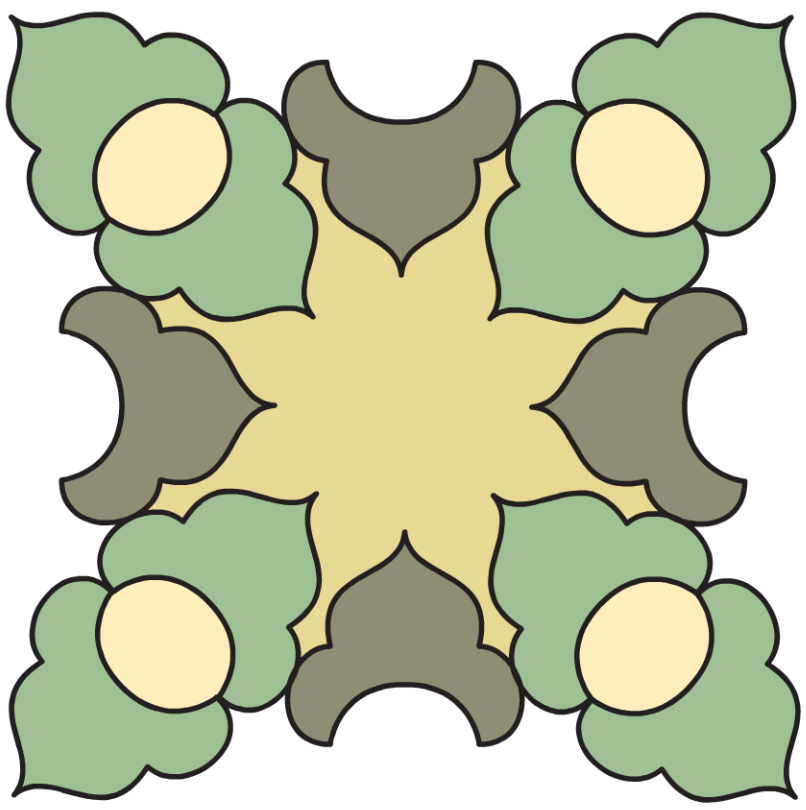

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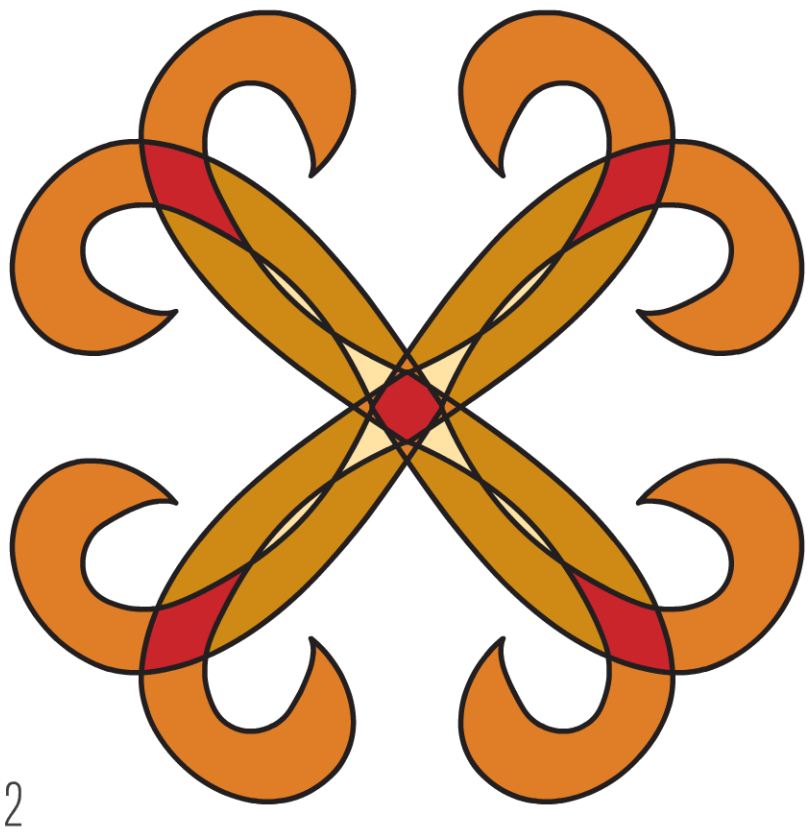

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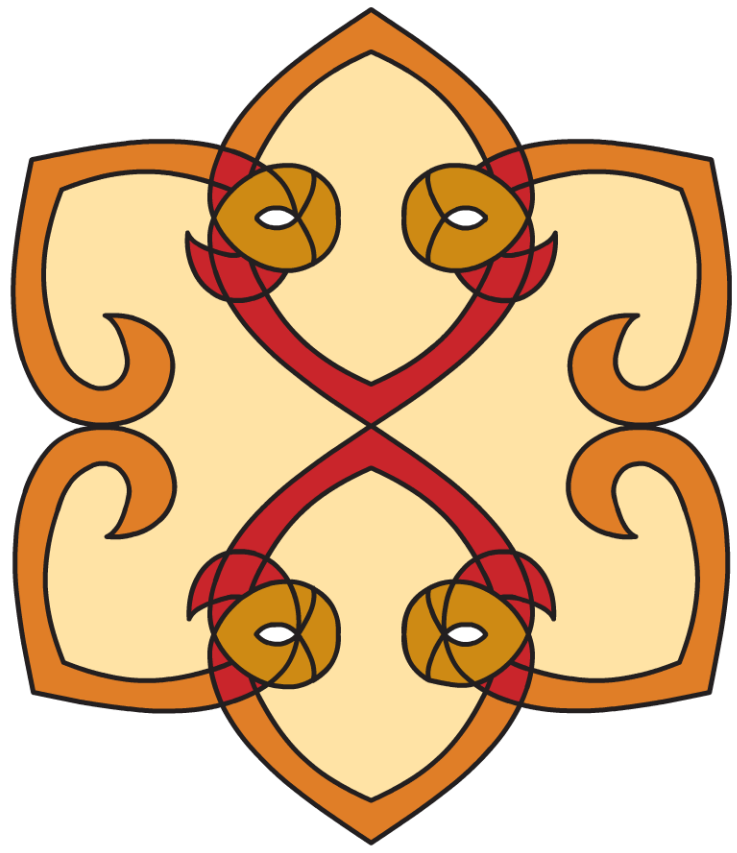

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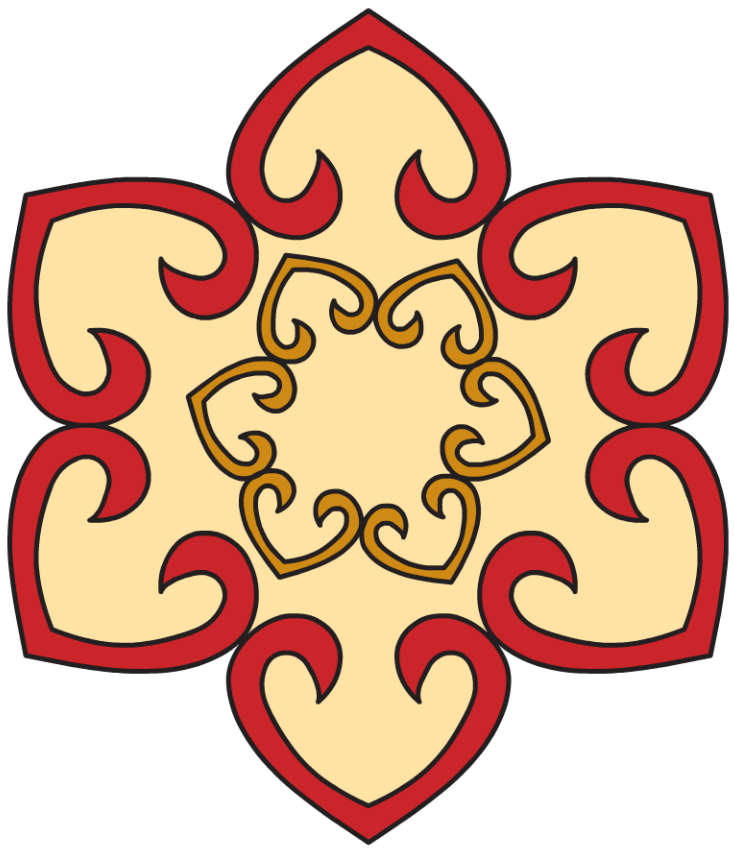

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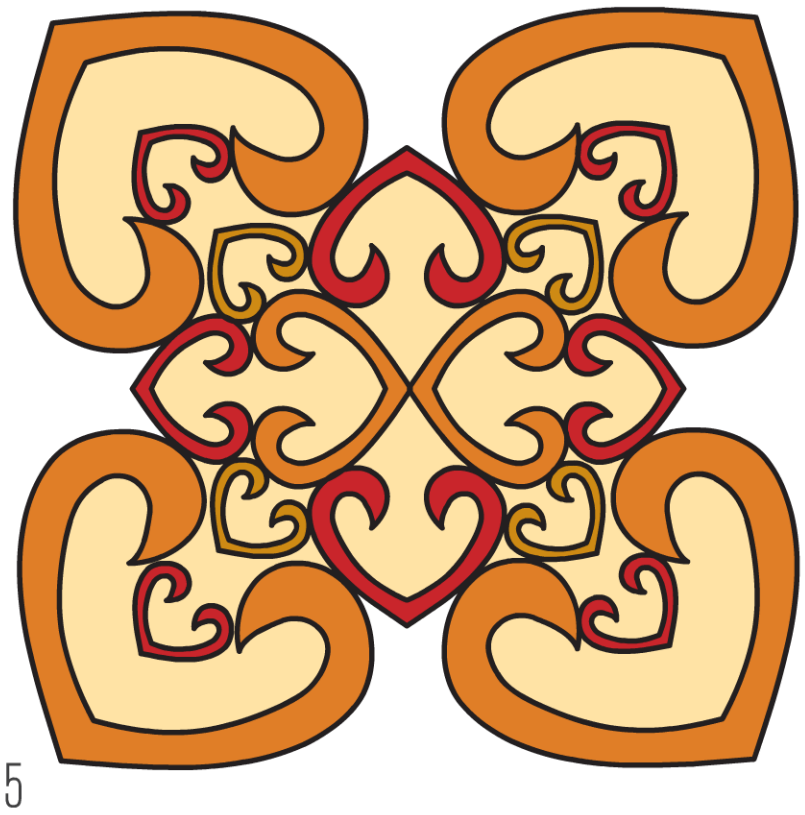

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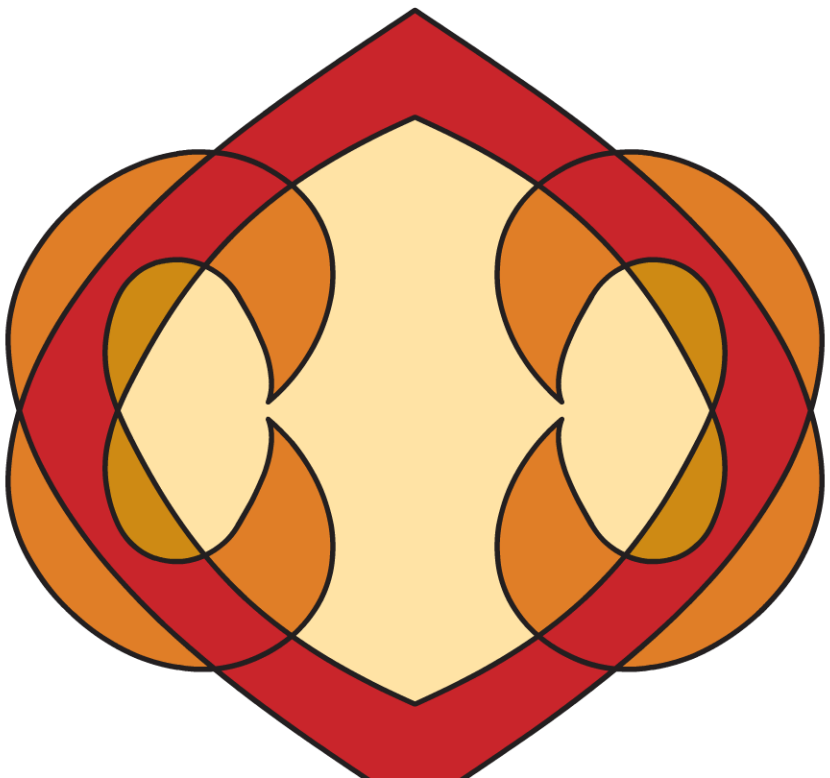

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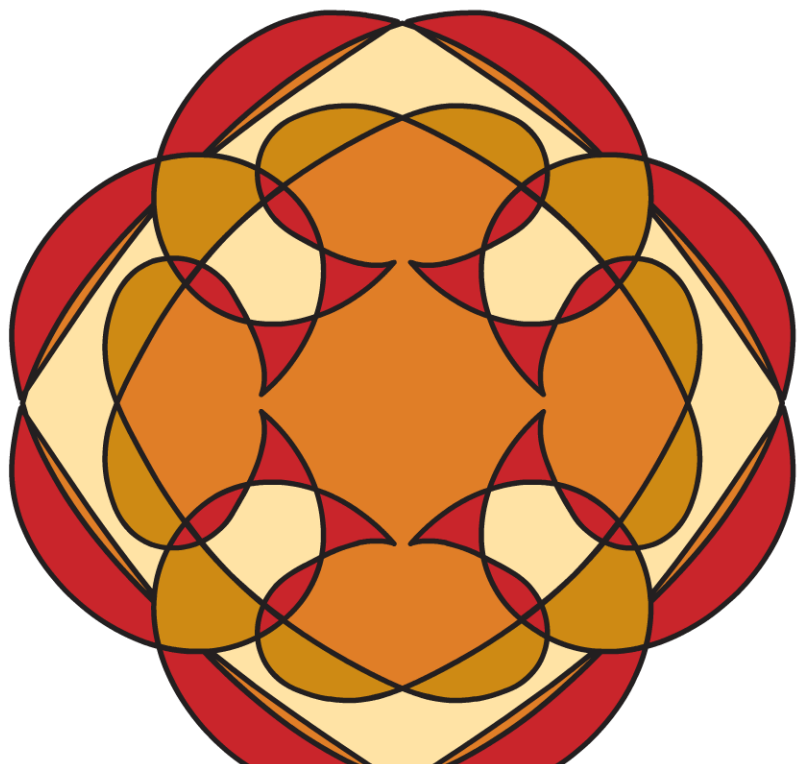

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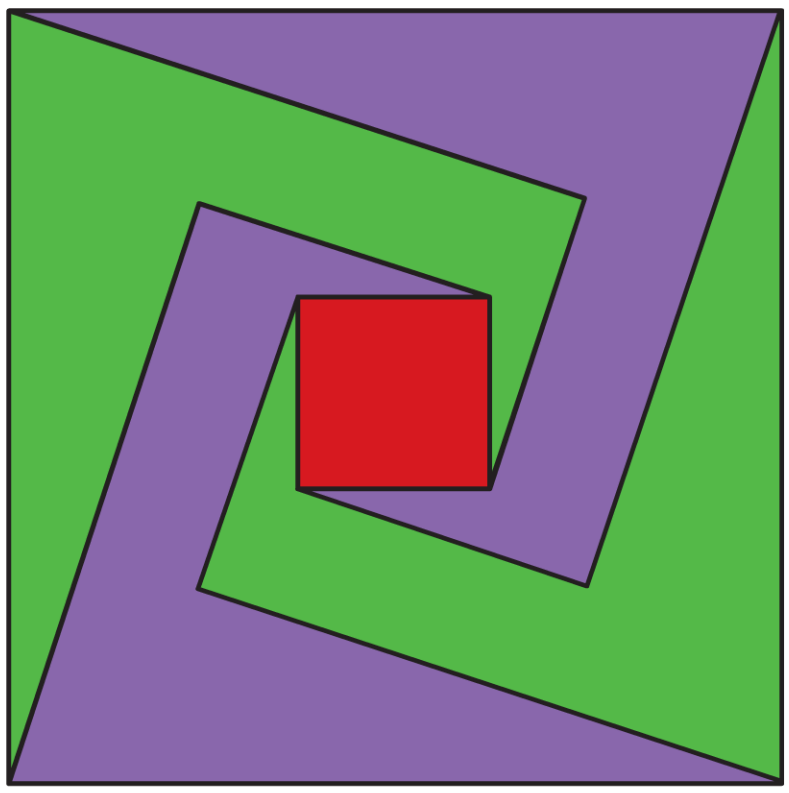

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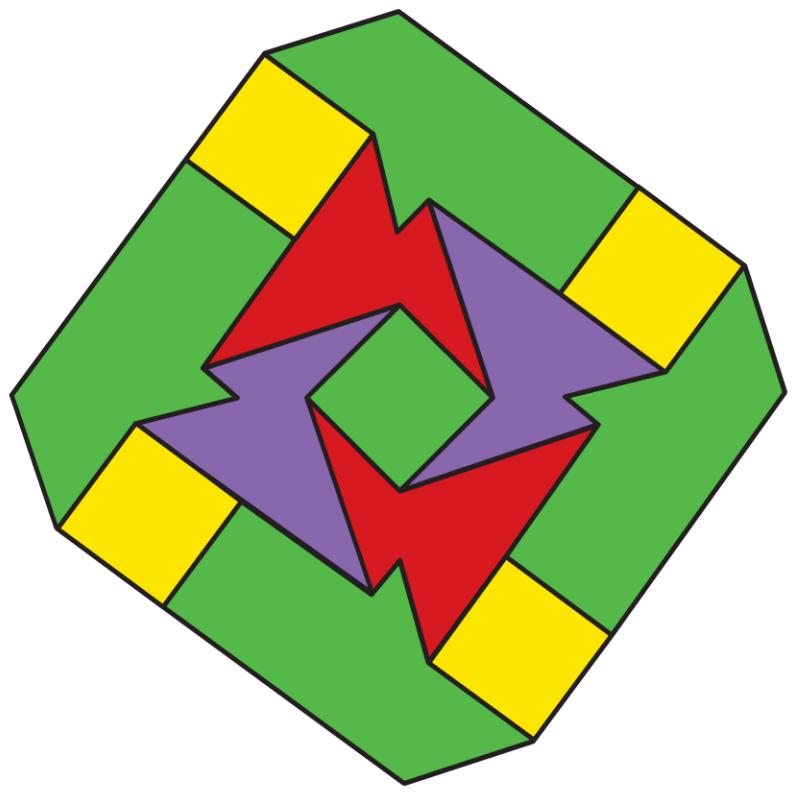

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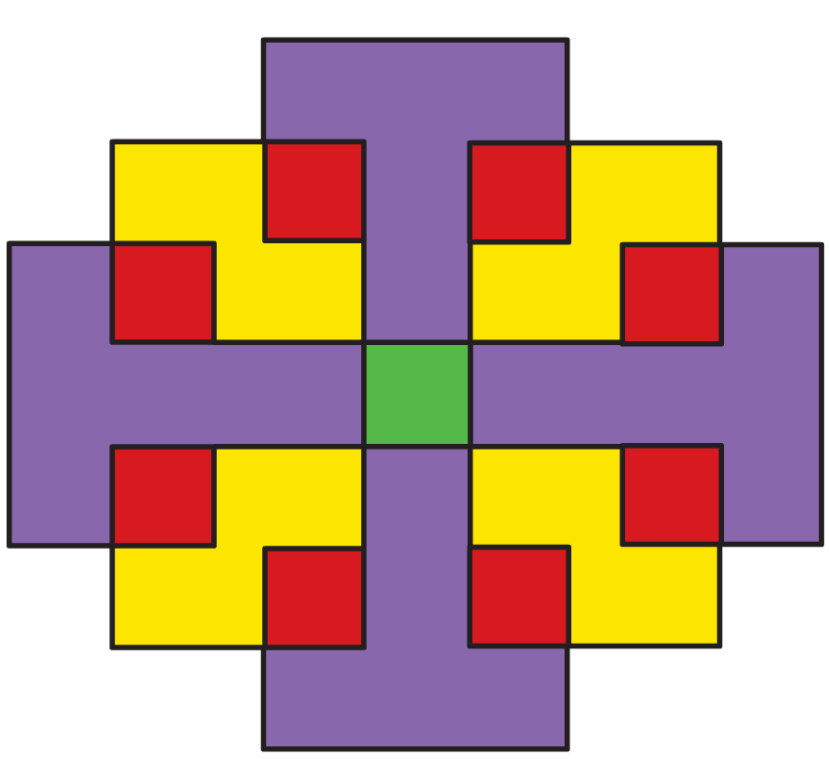

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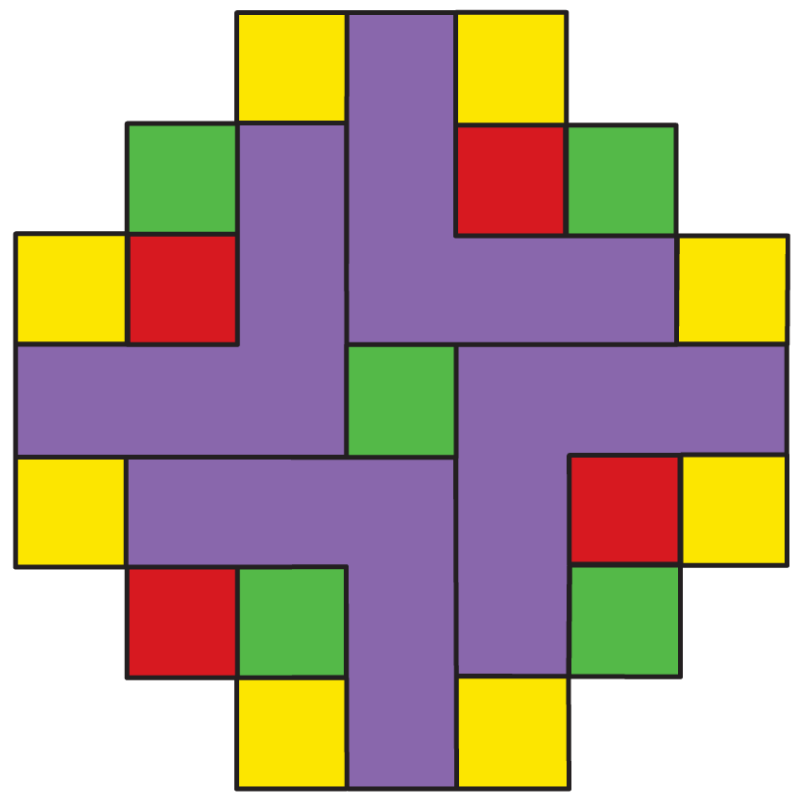

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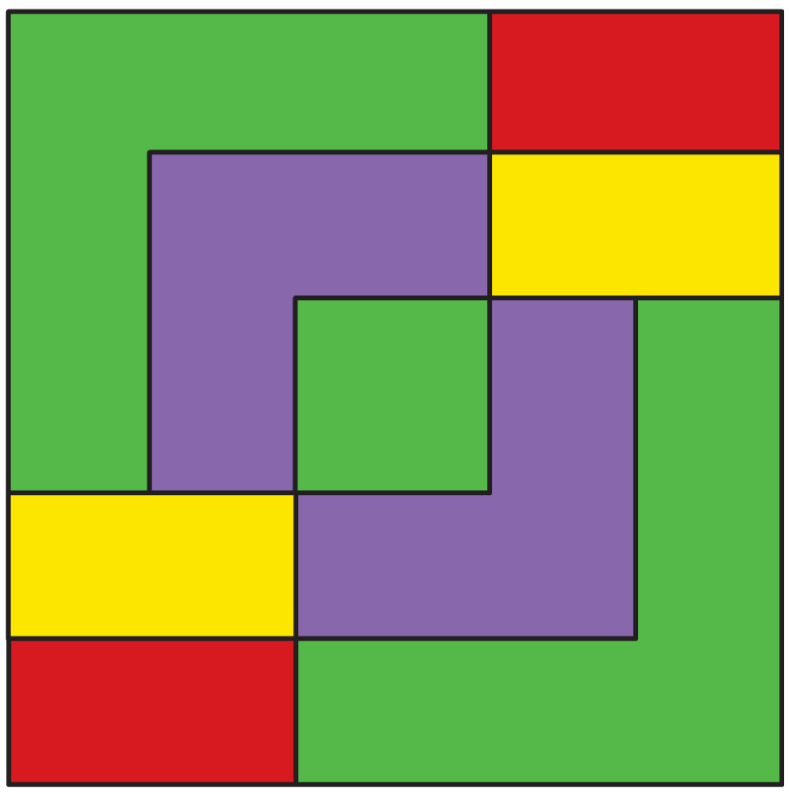

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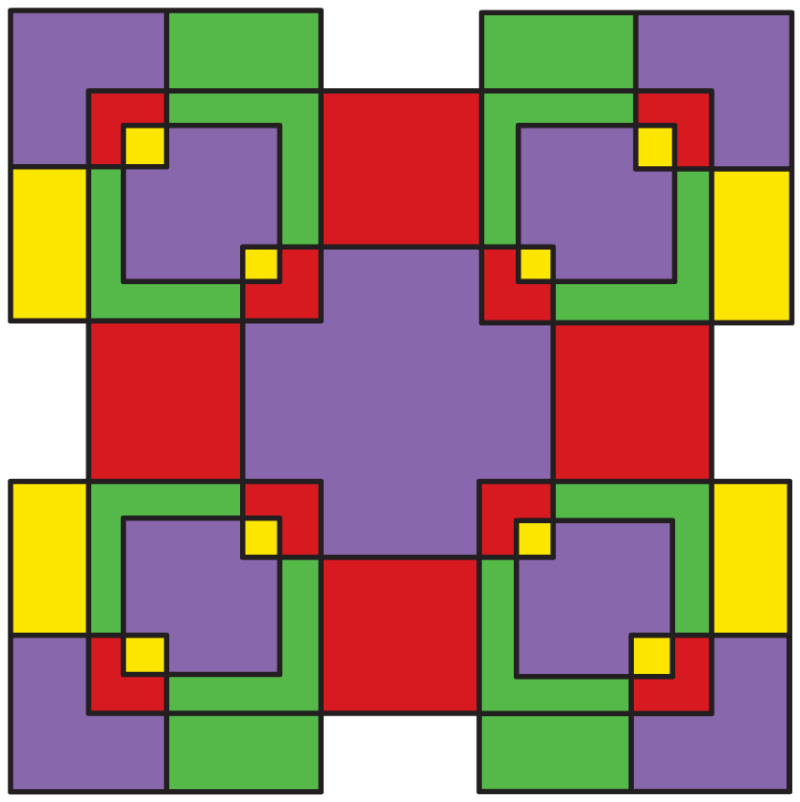

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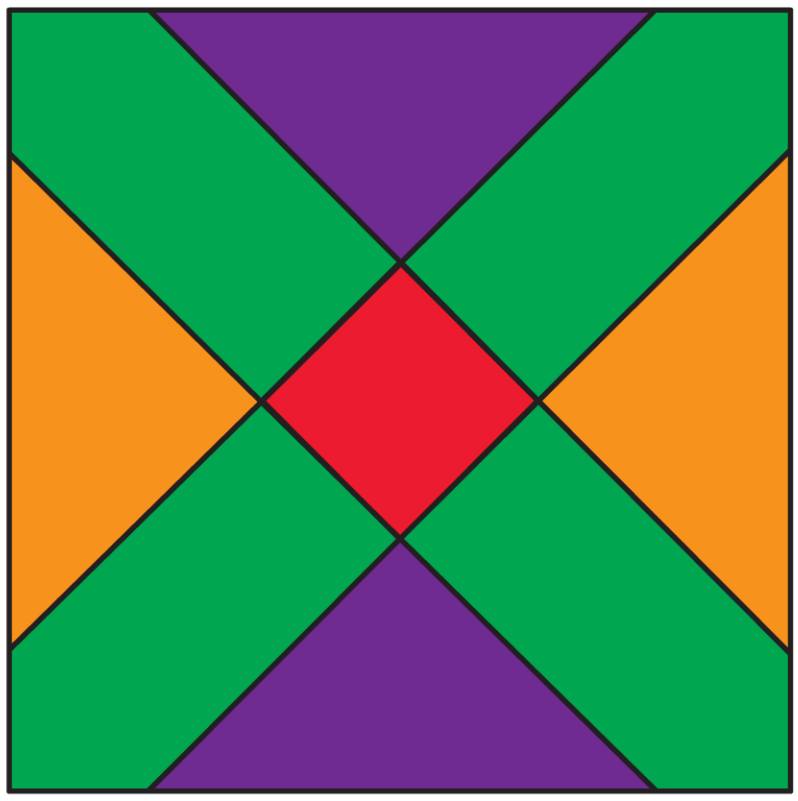

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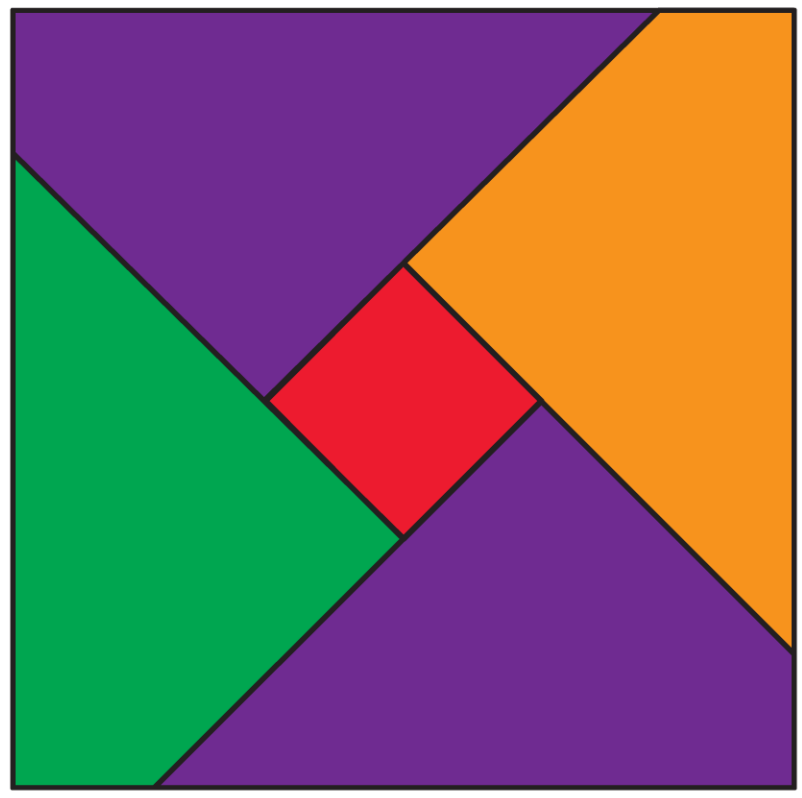

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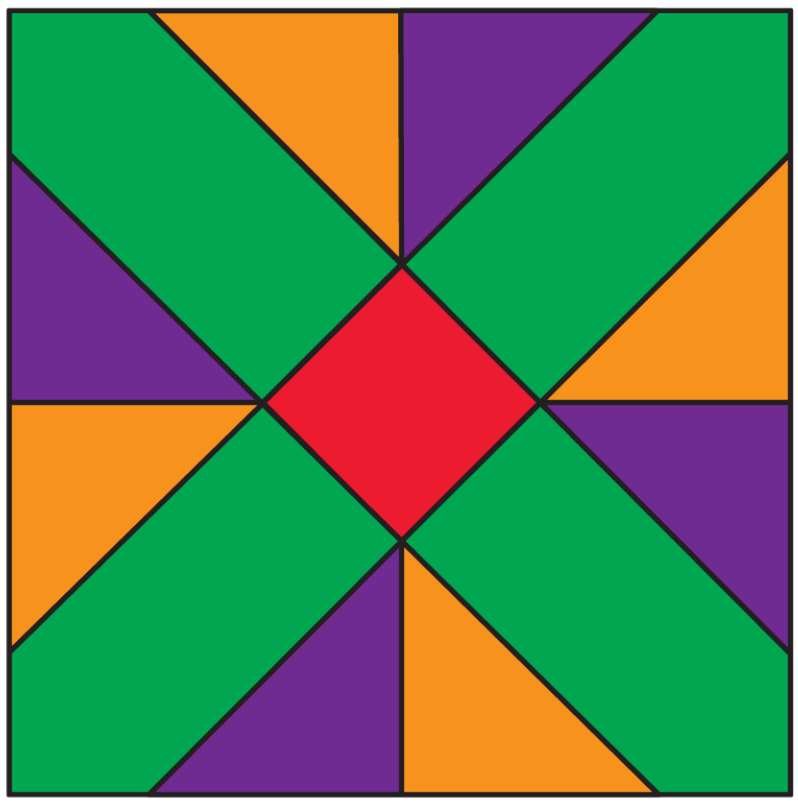

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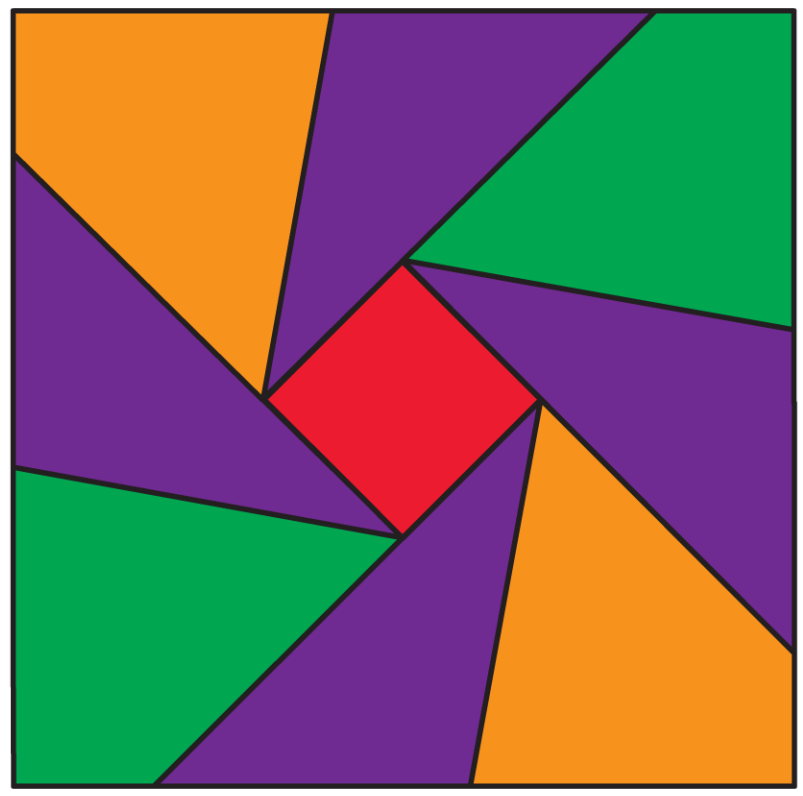

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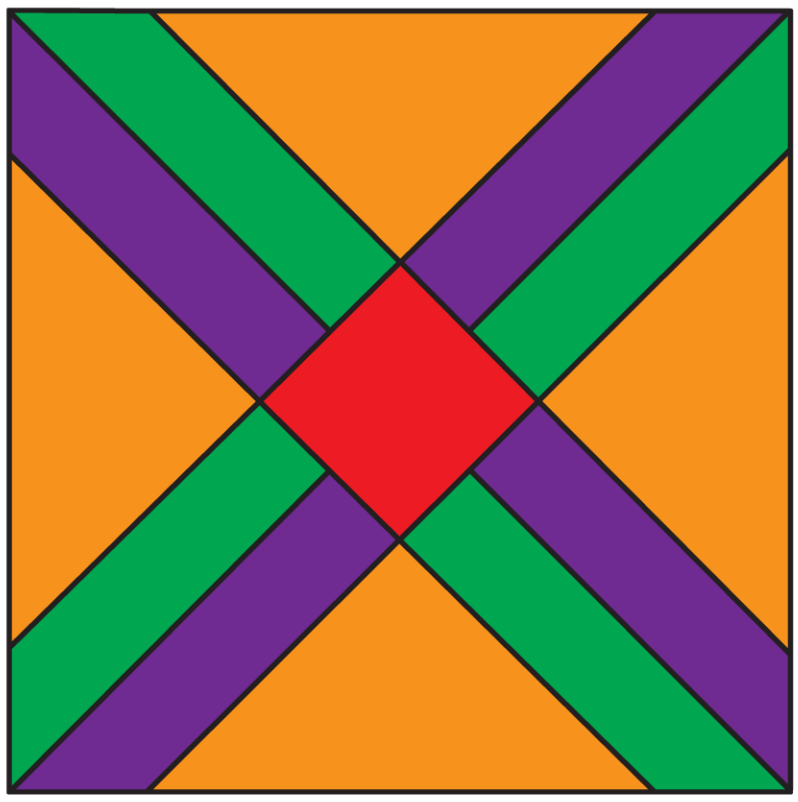

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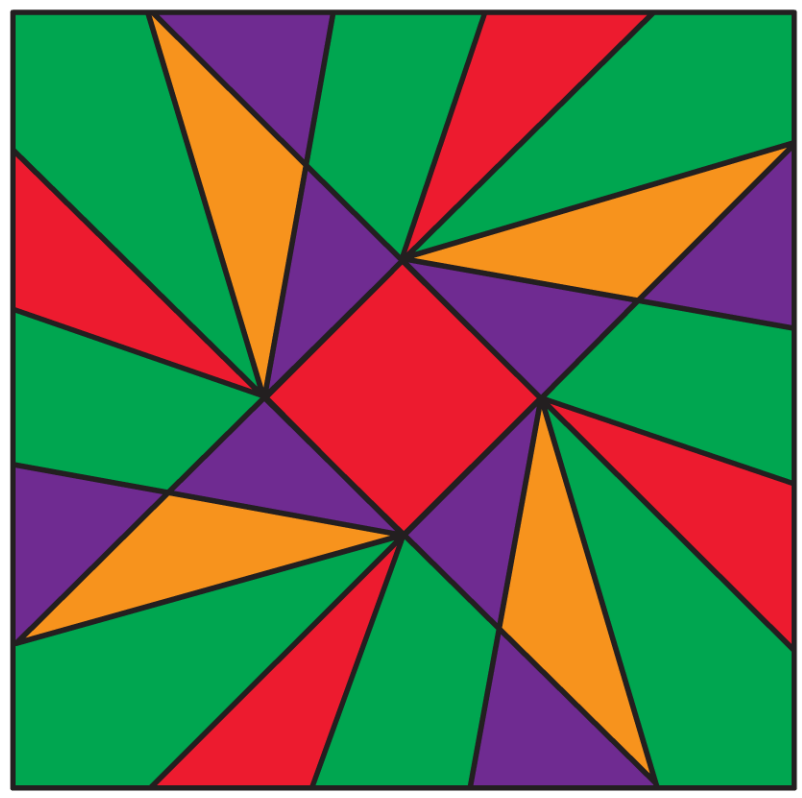

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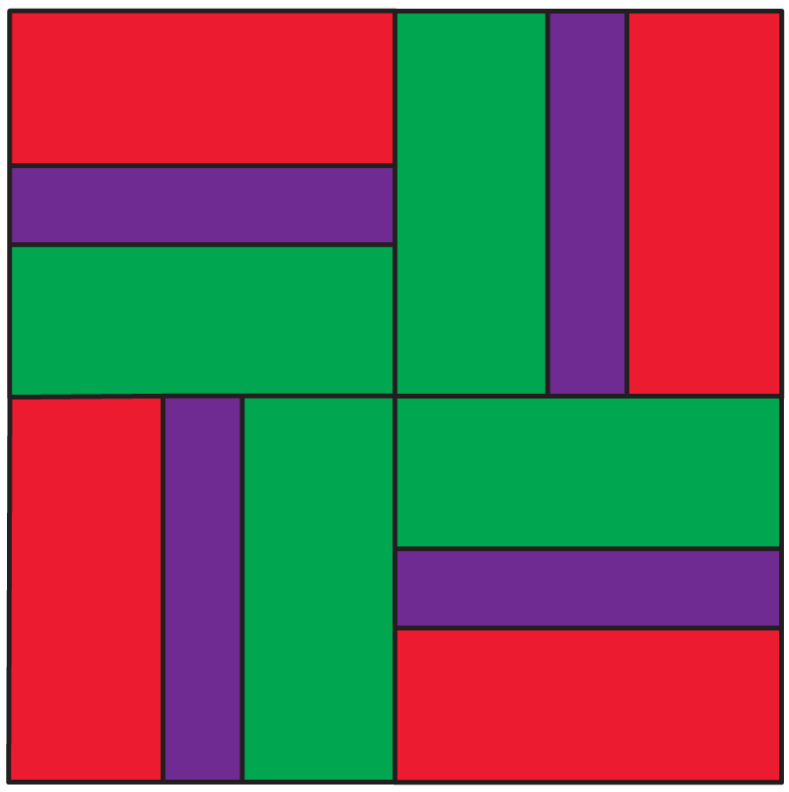

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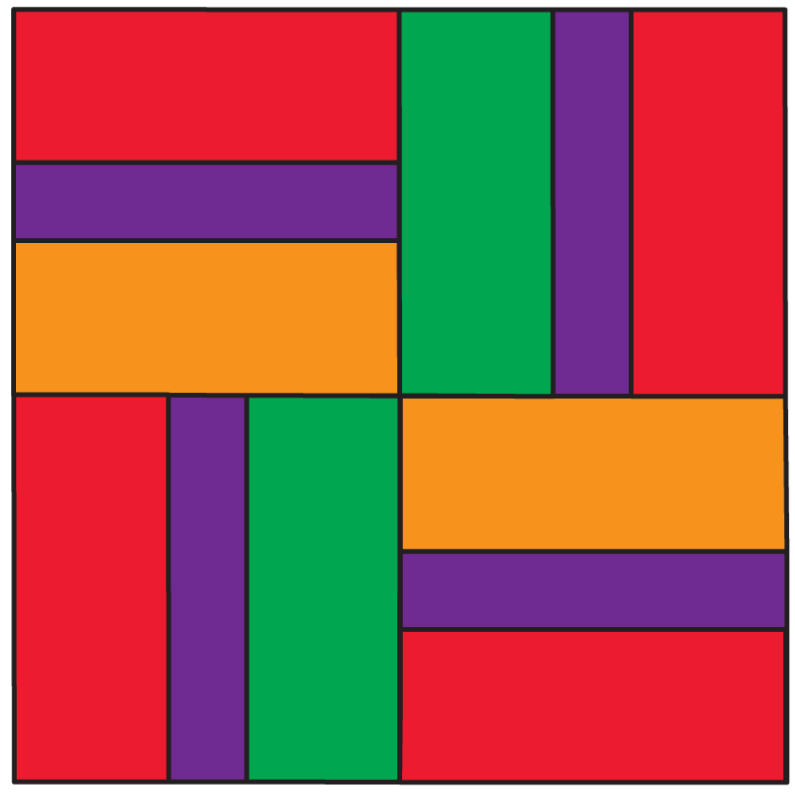

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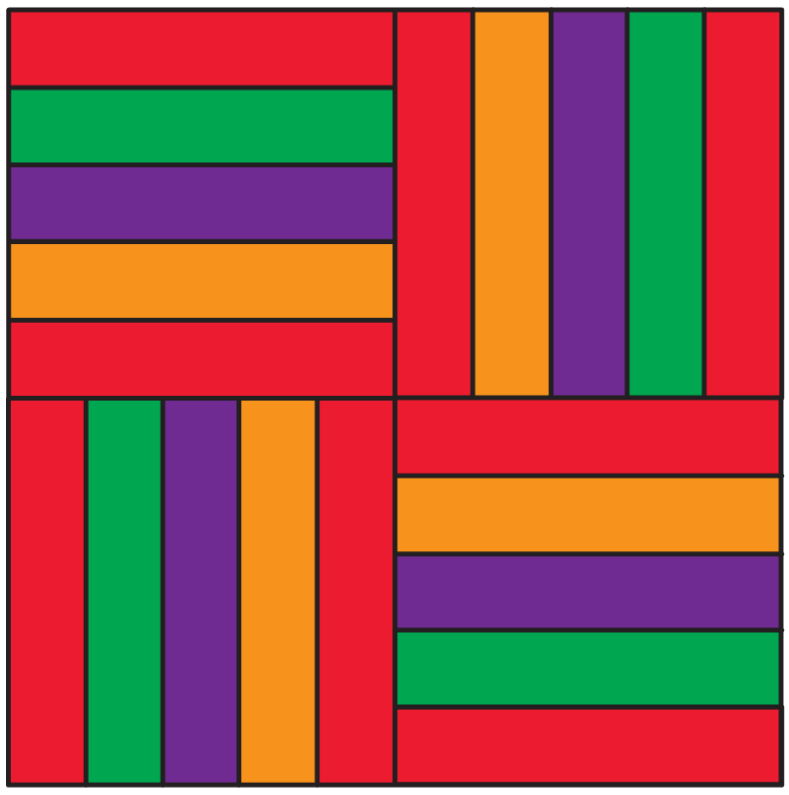

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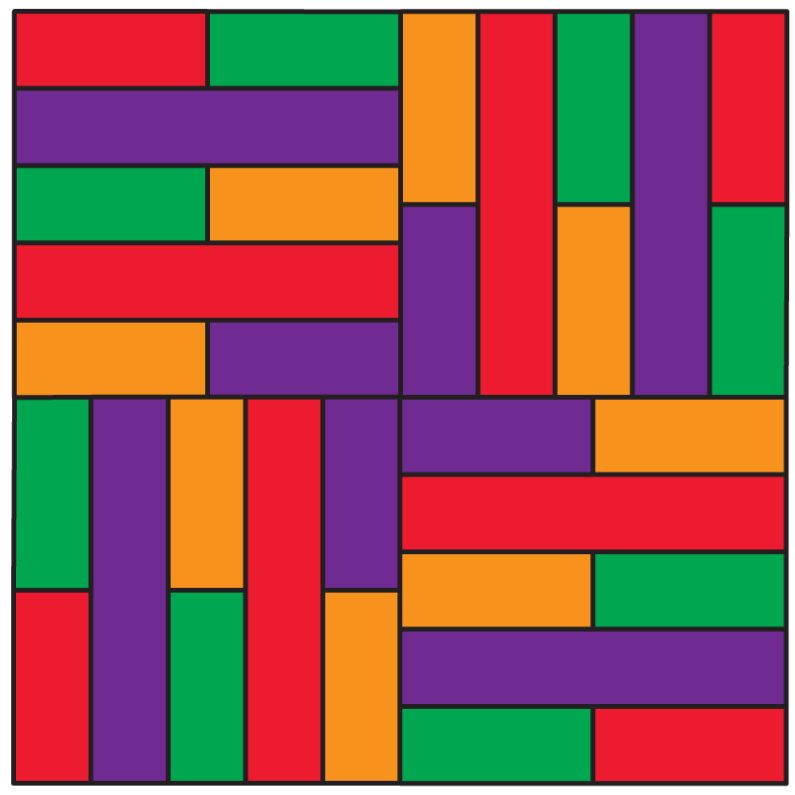

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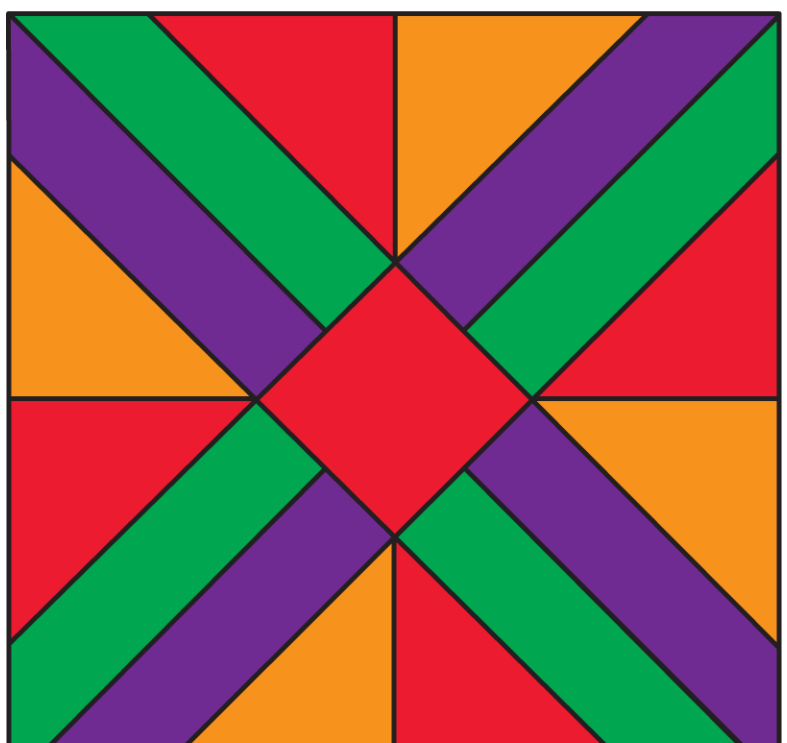

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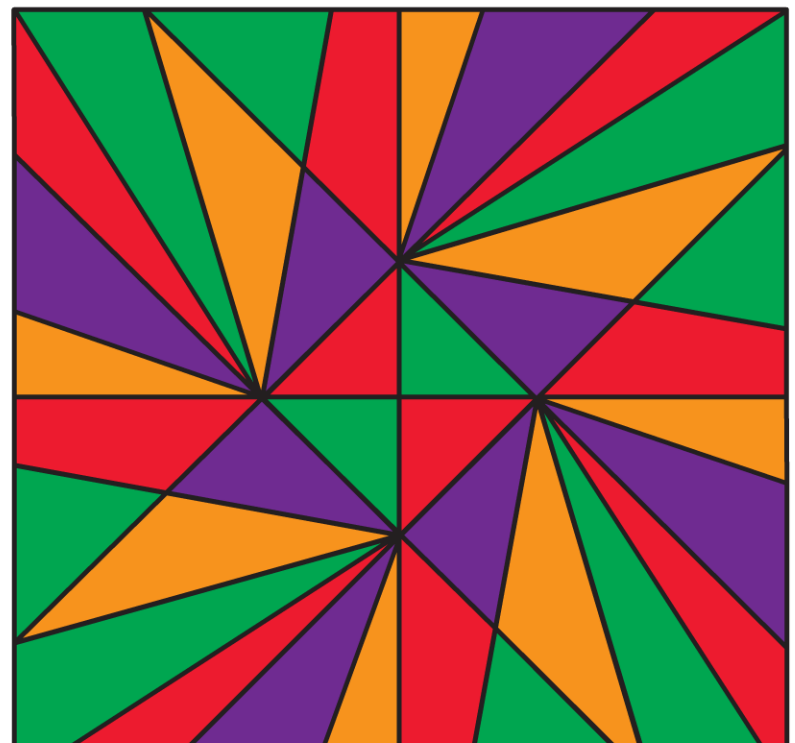

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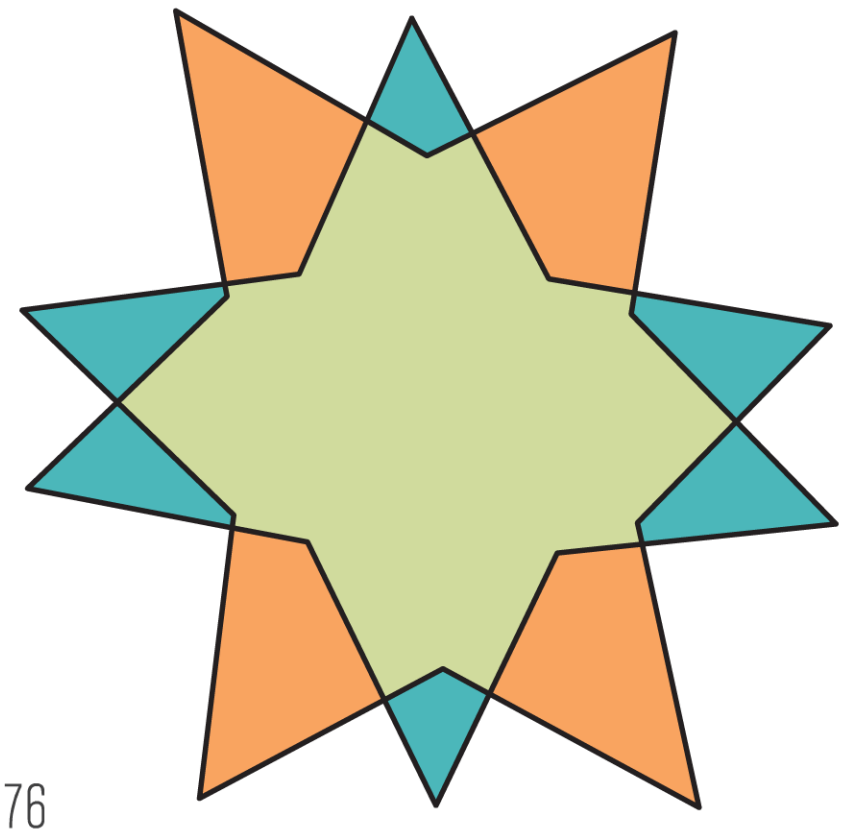

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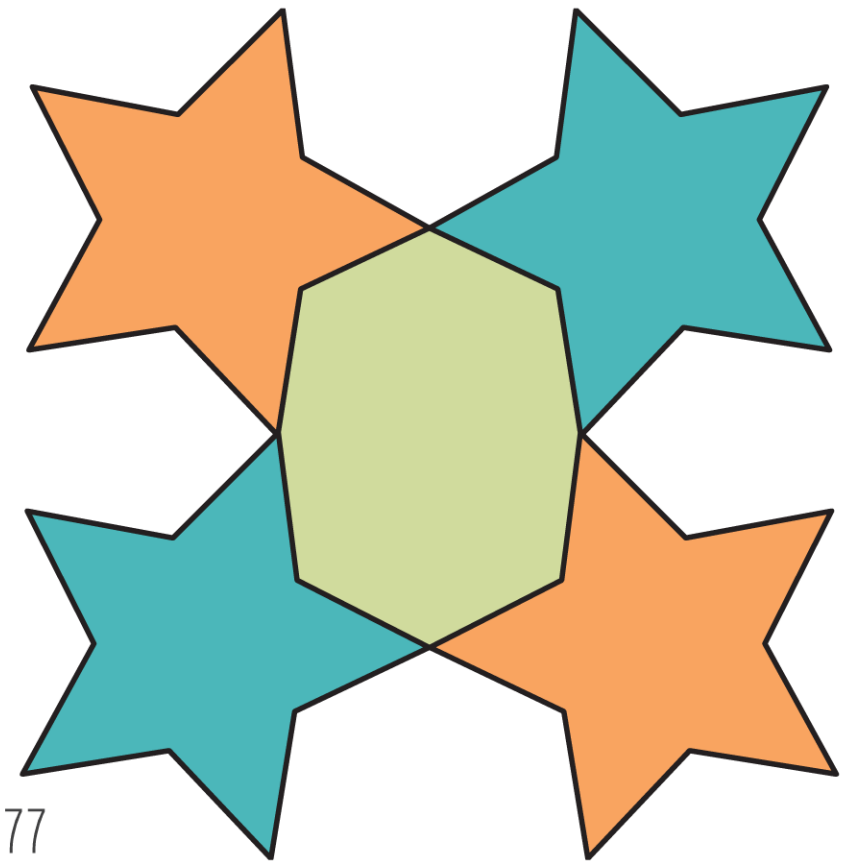

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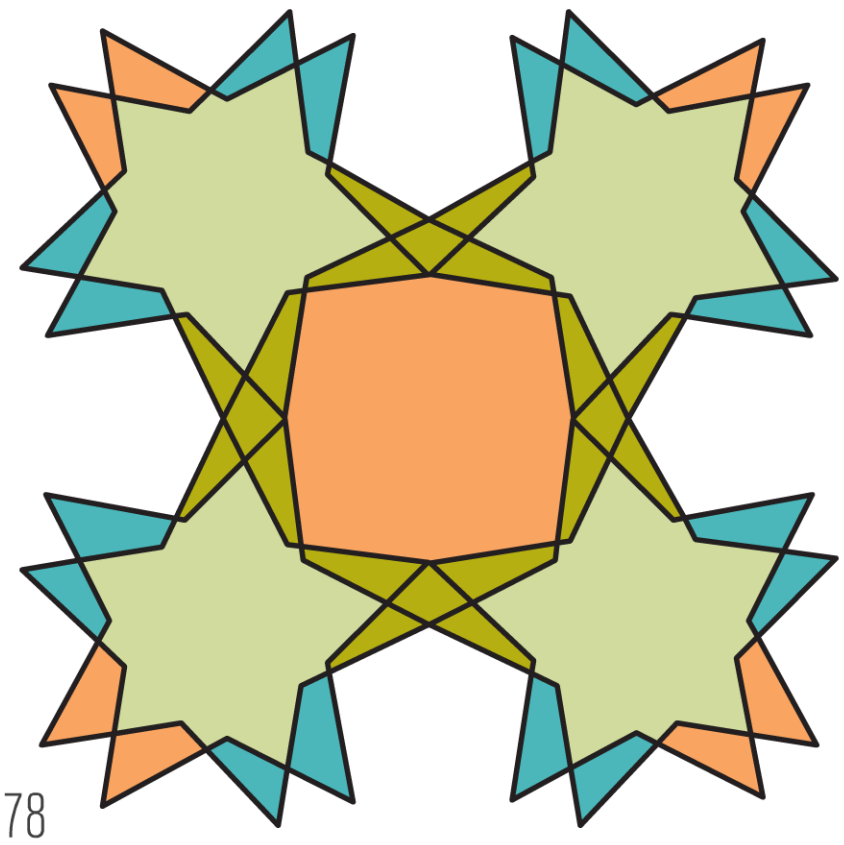

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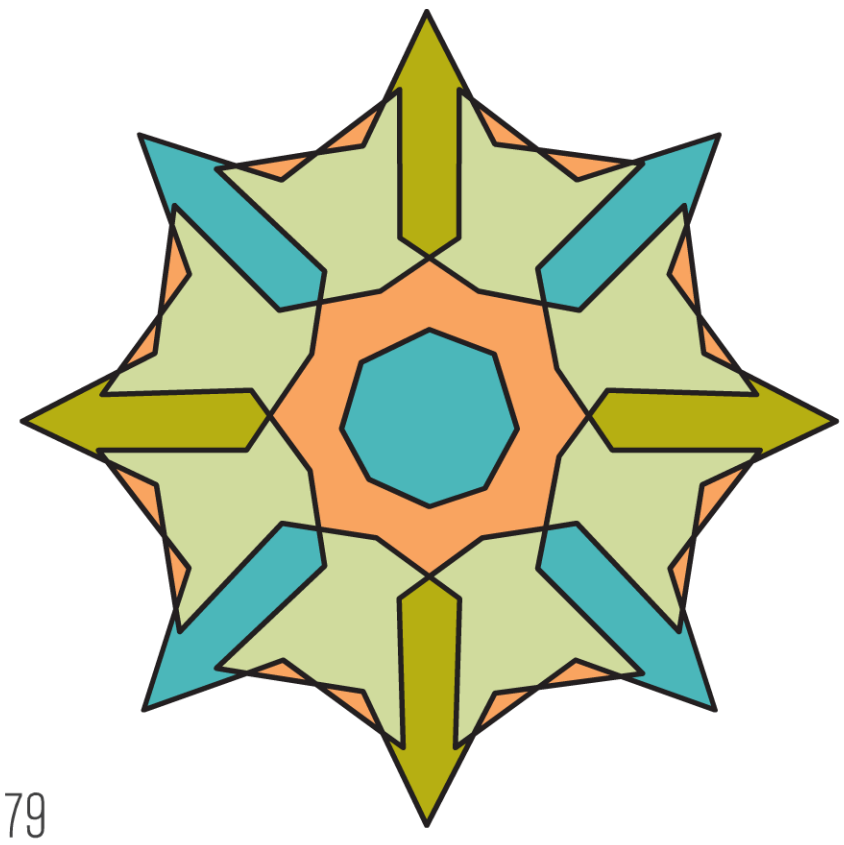

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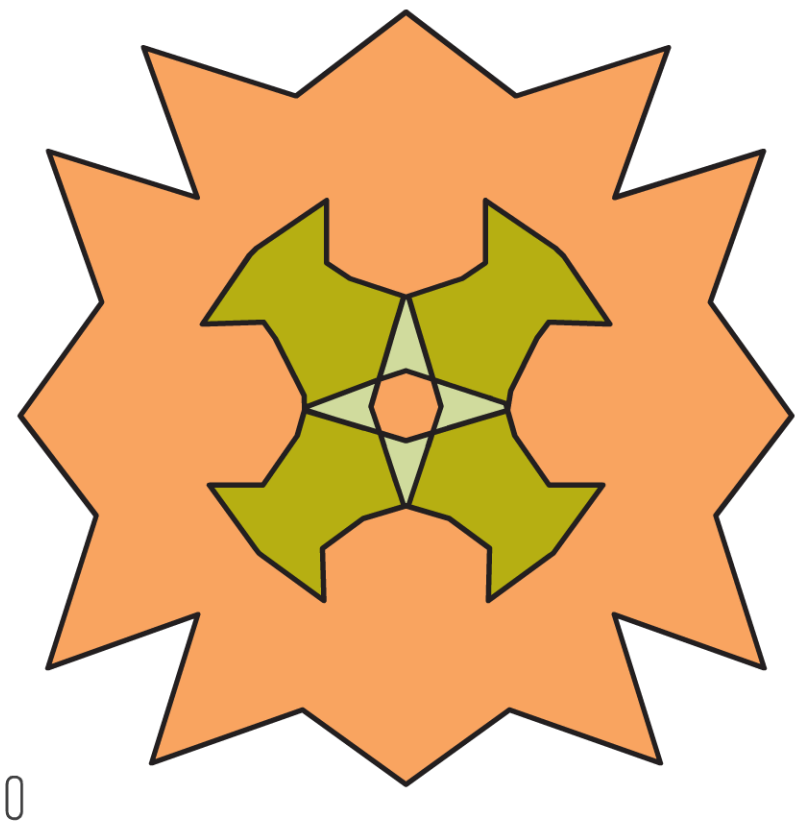

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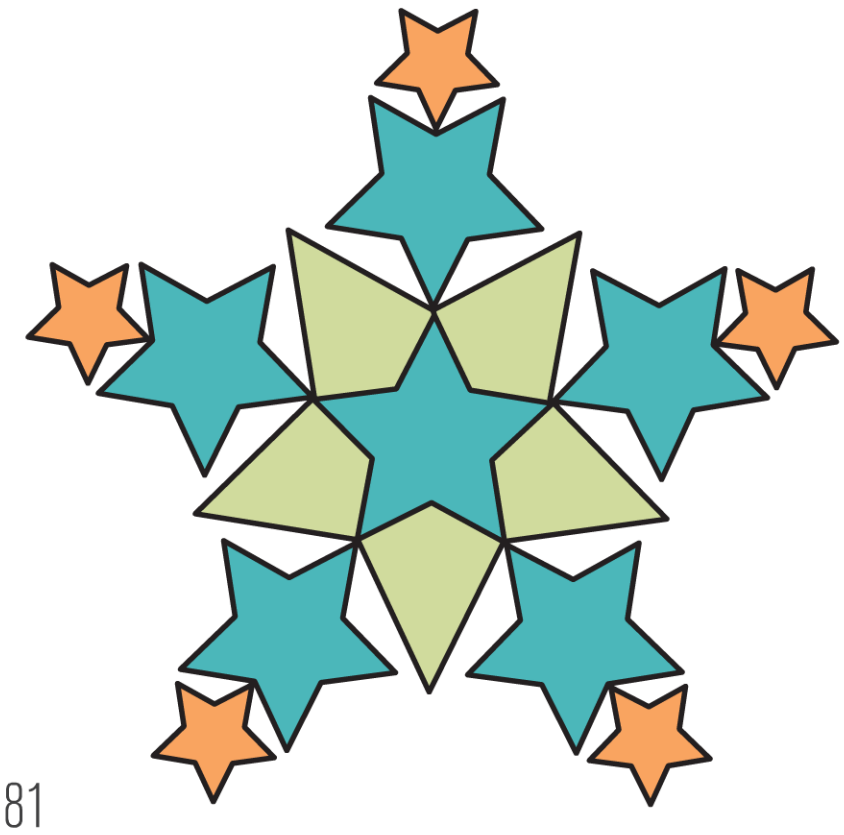

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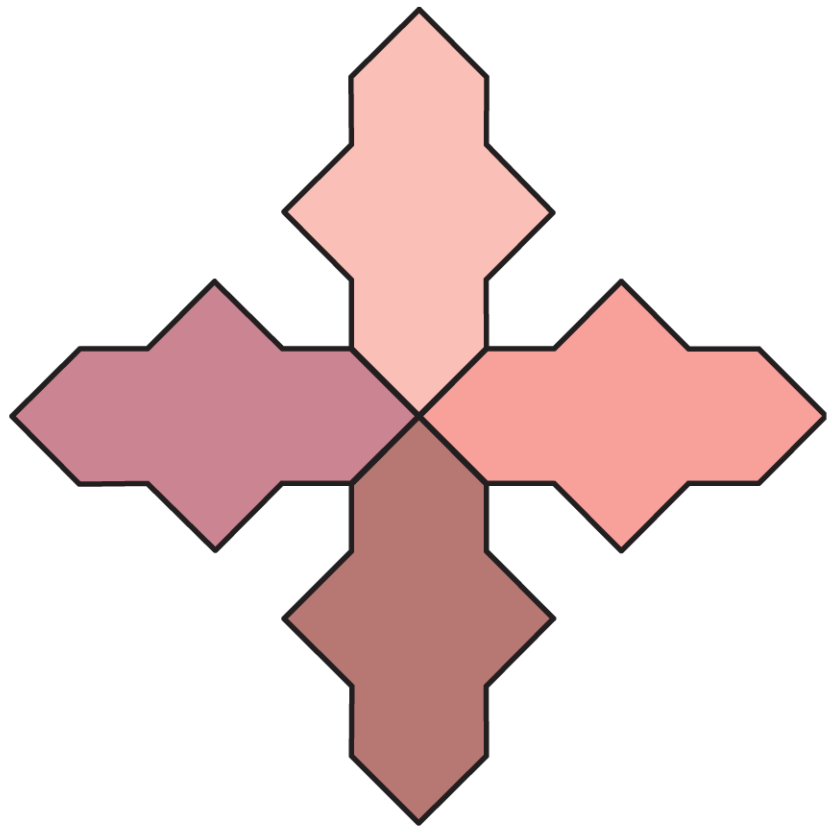

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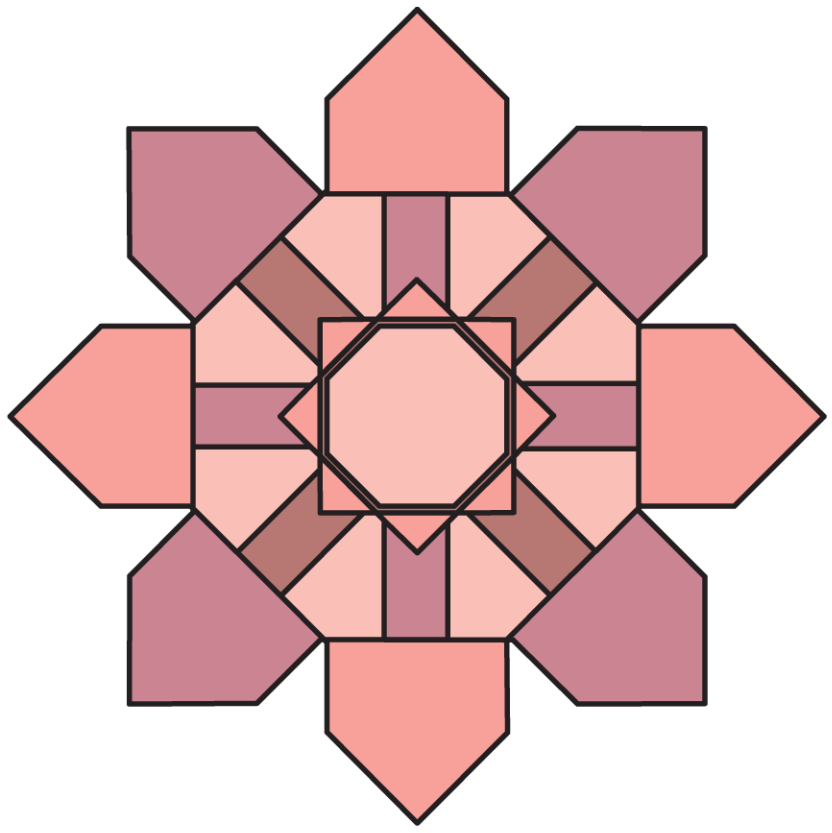

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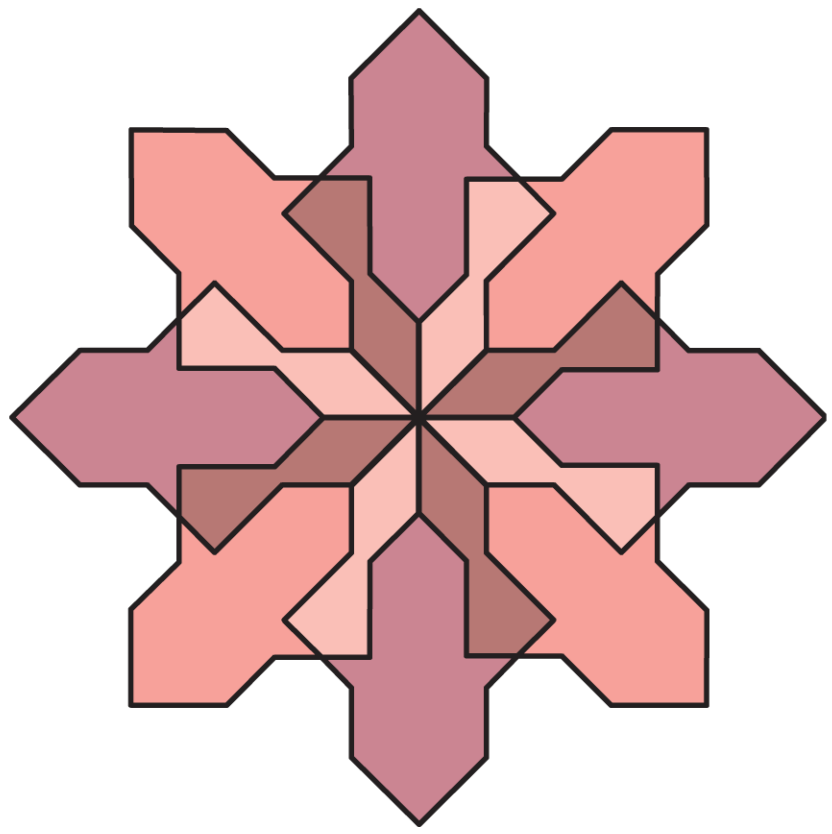

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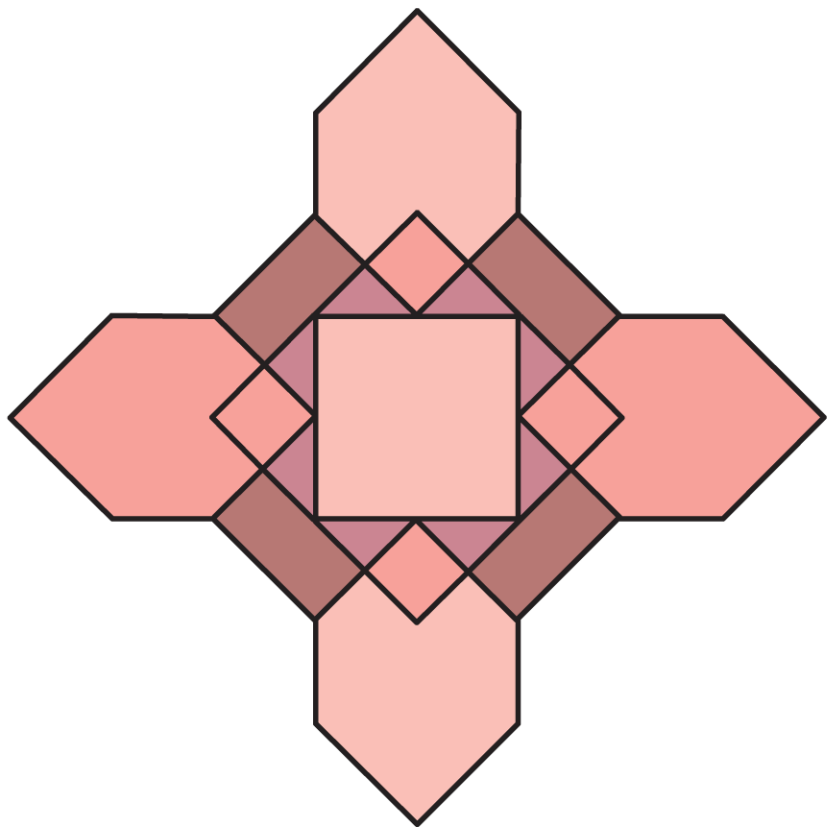

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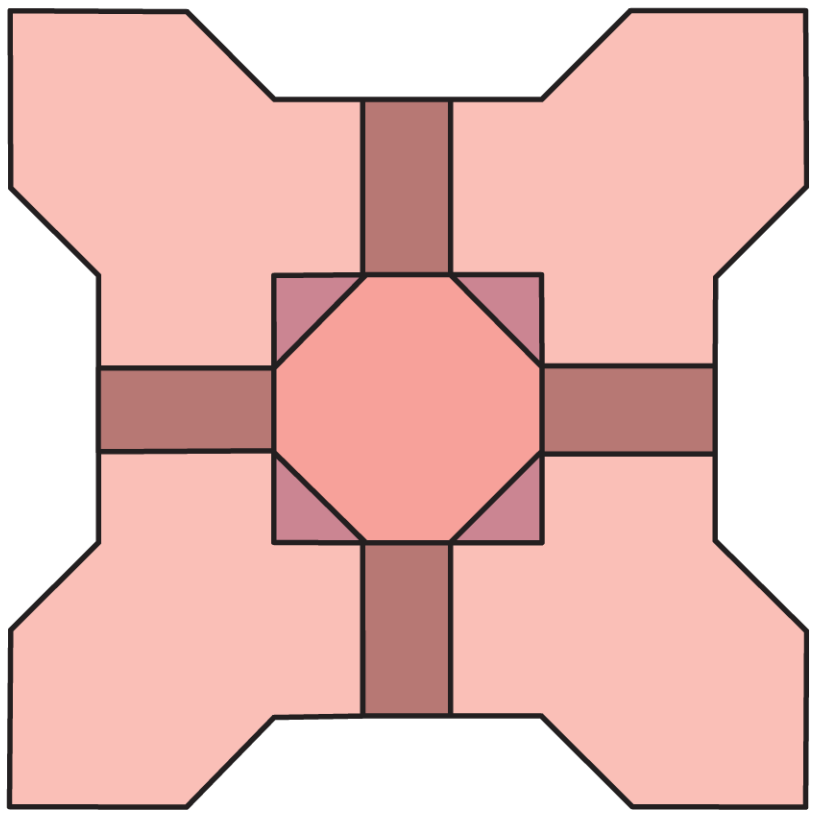

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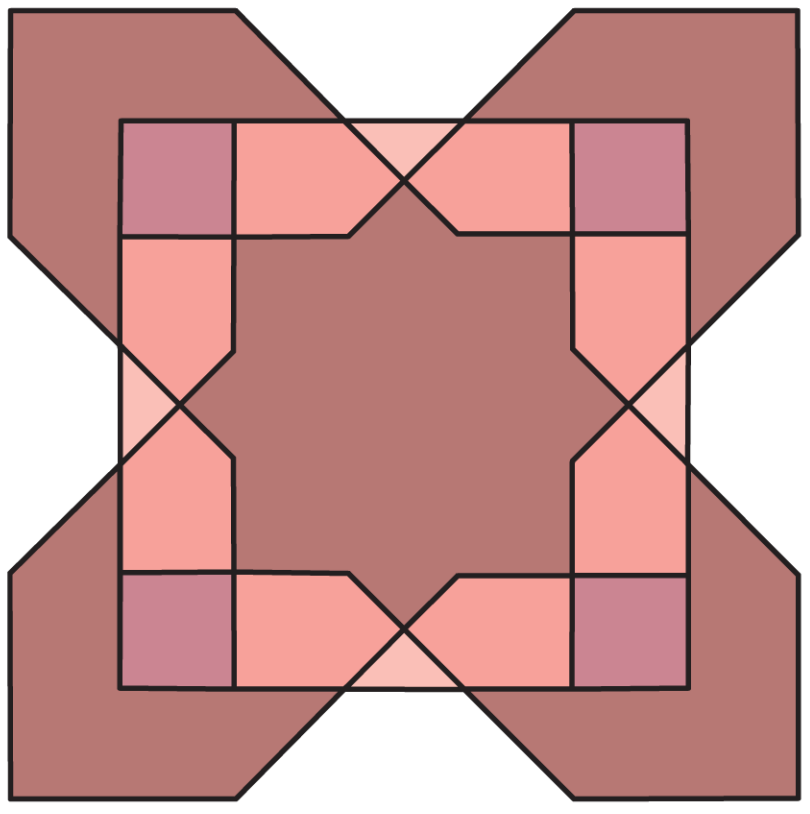

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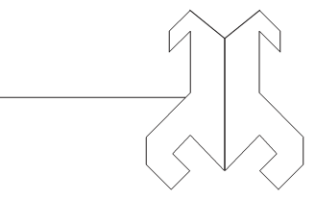

Top Dogs

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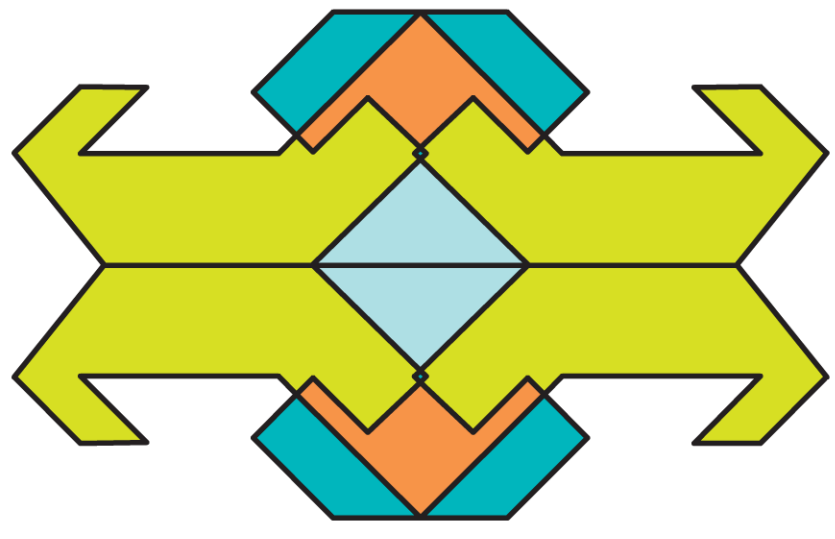

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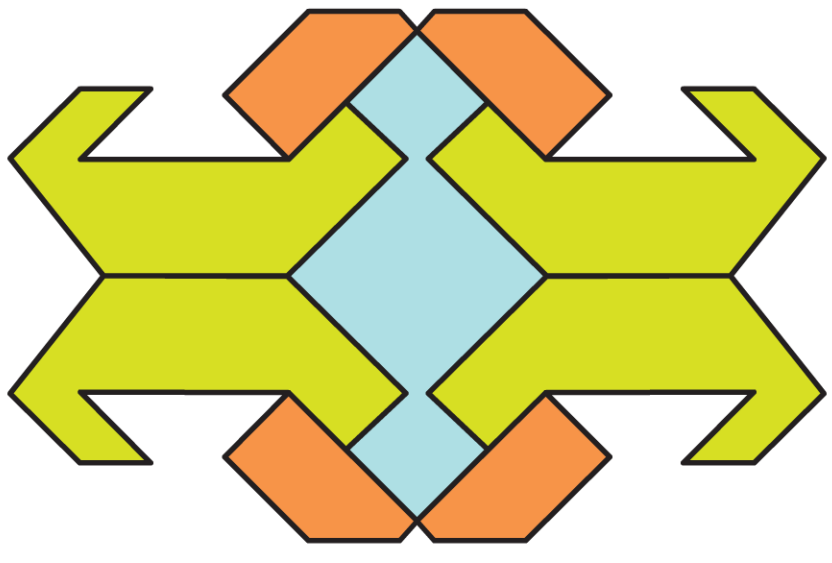

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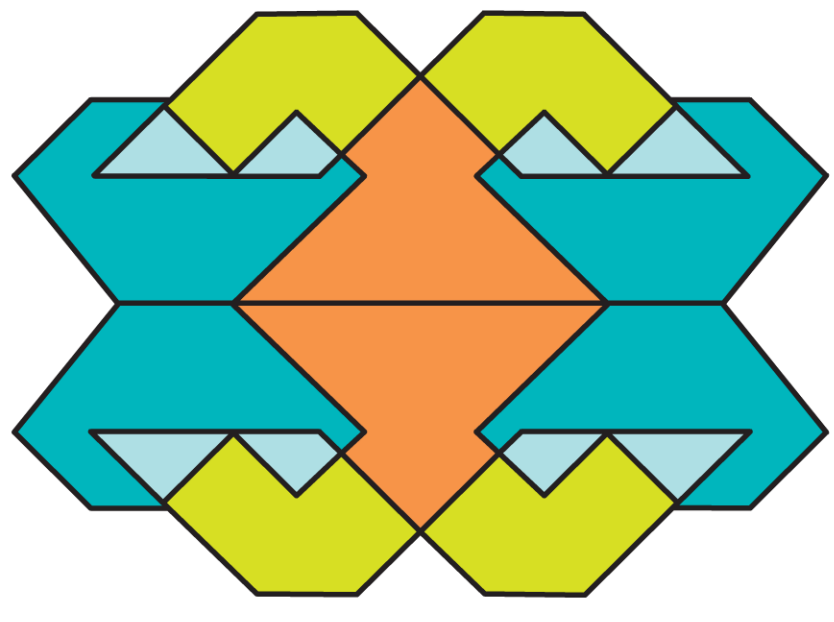

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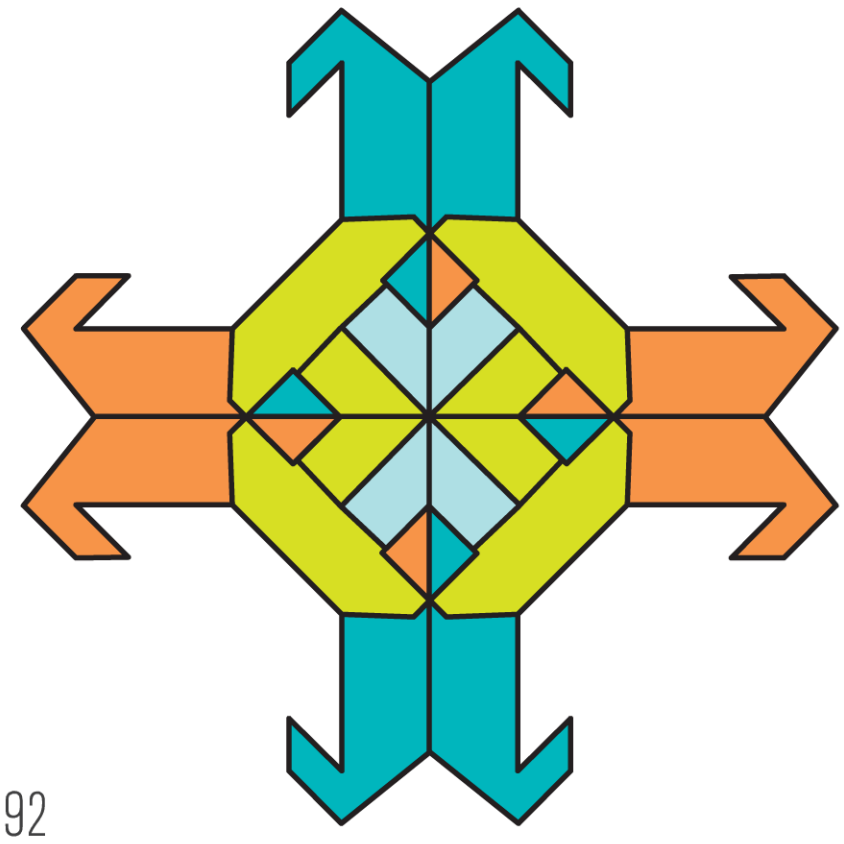
Top Dogs



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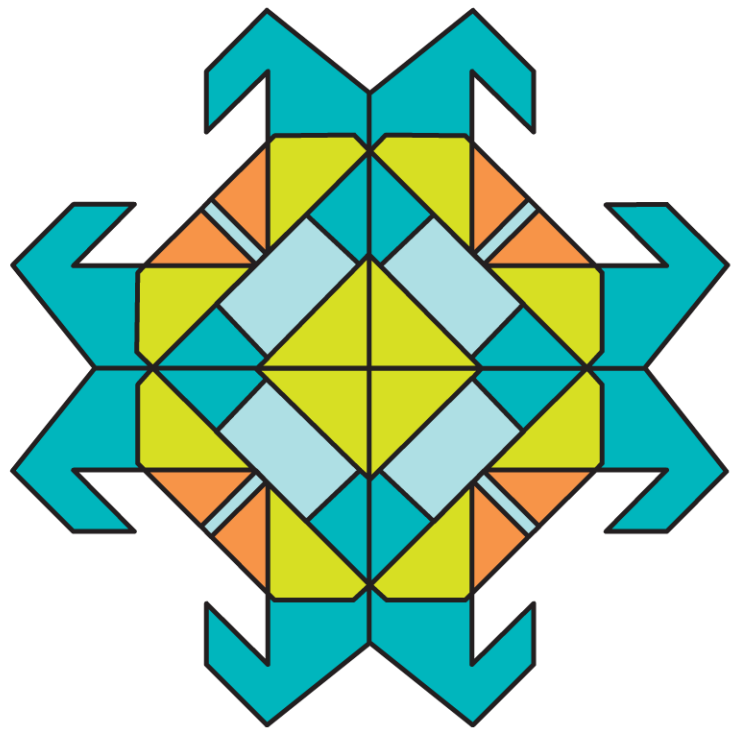

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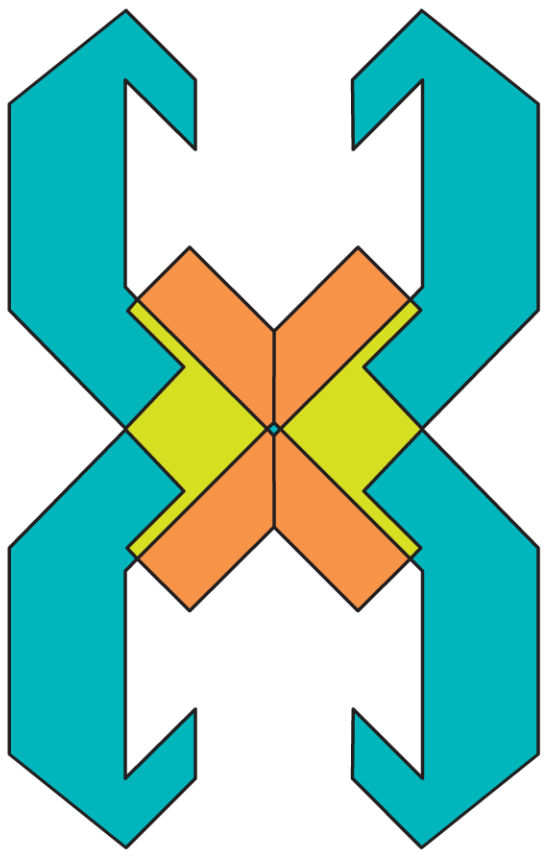

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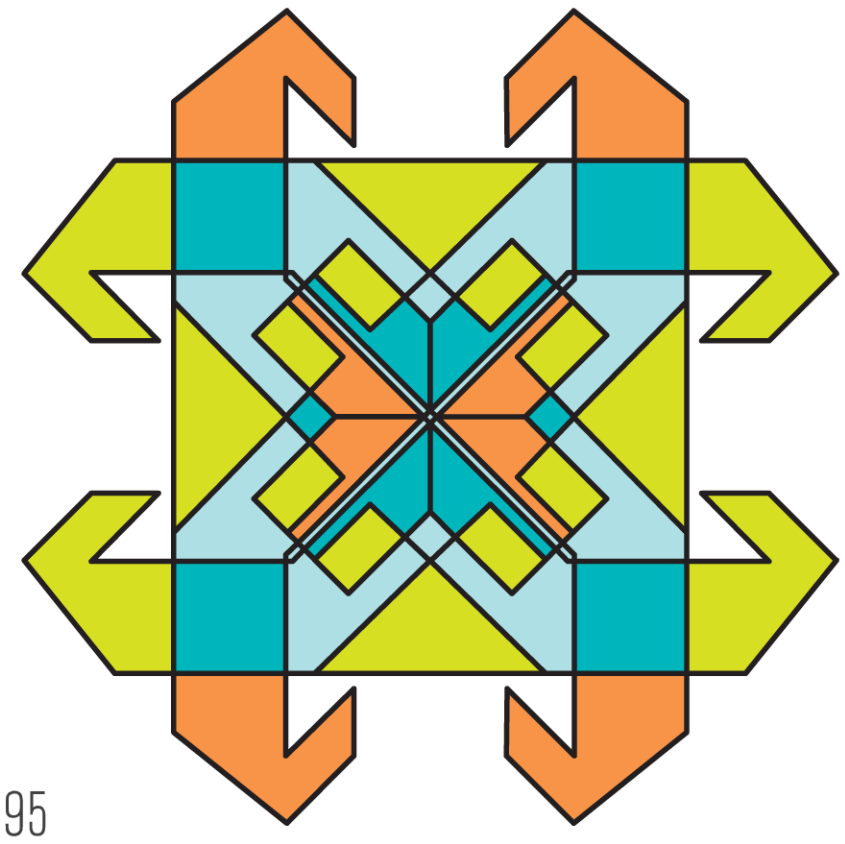

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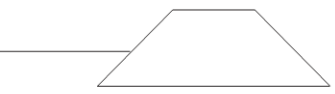

Trapezoids

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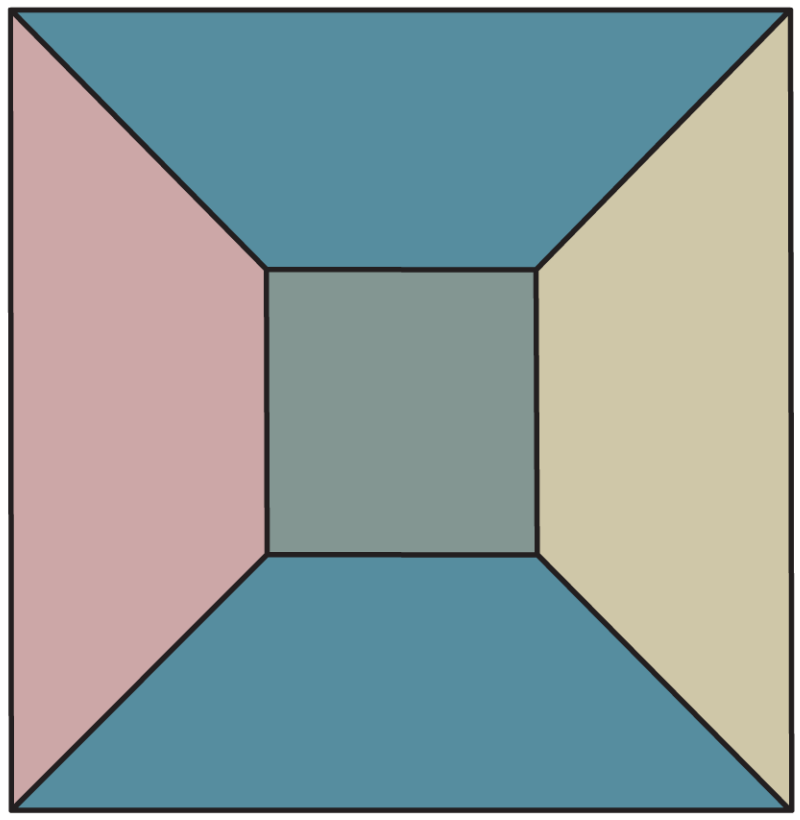

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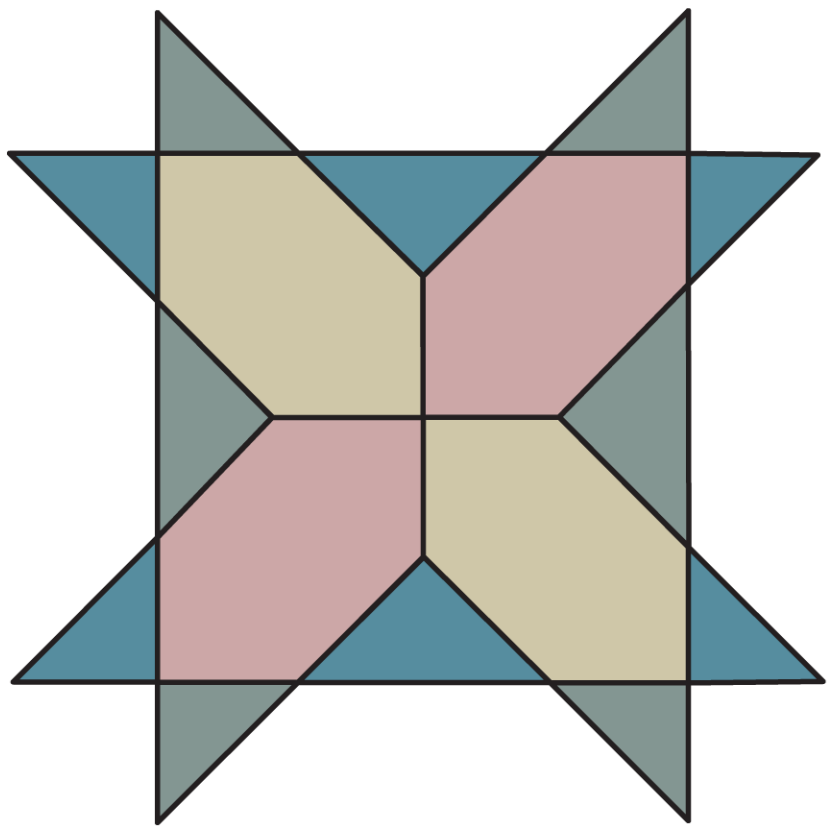

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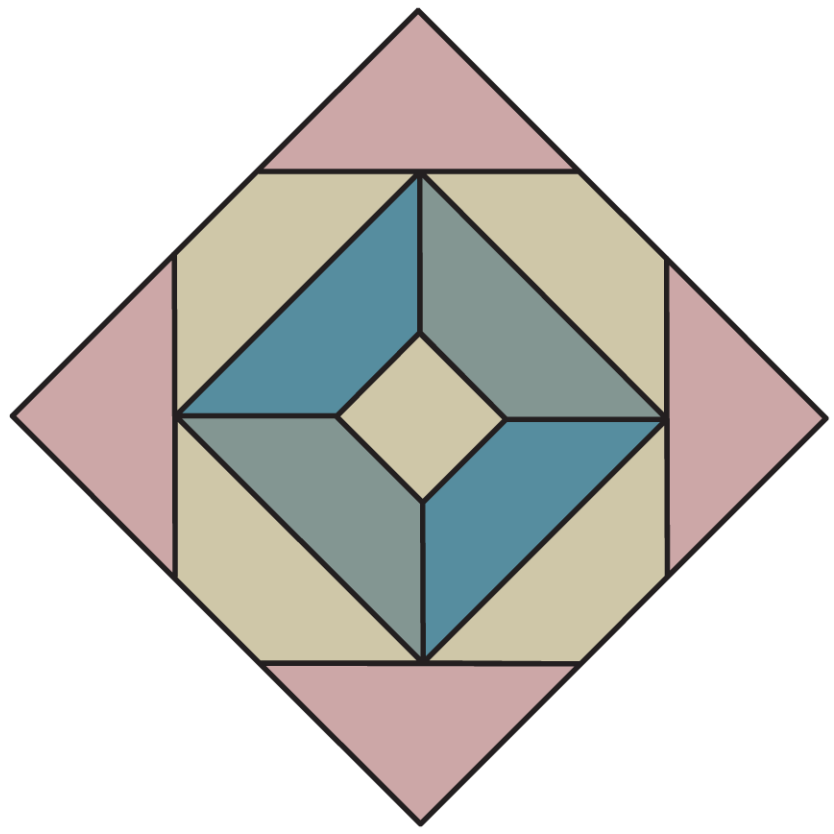
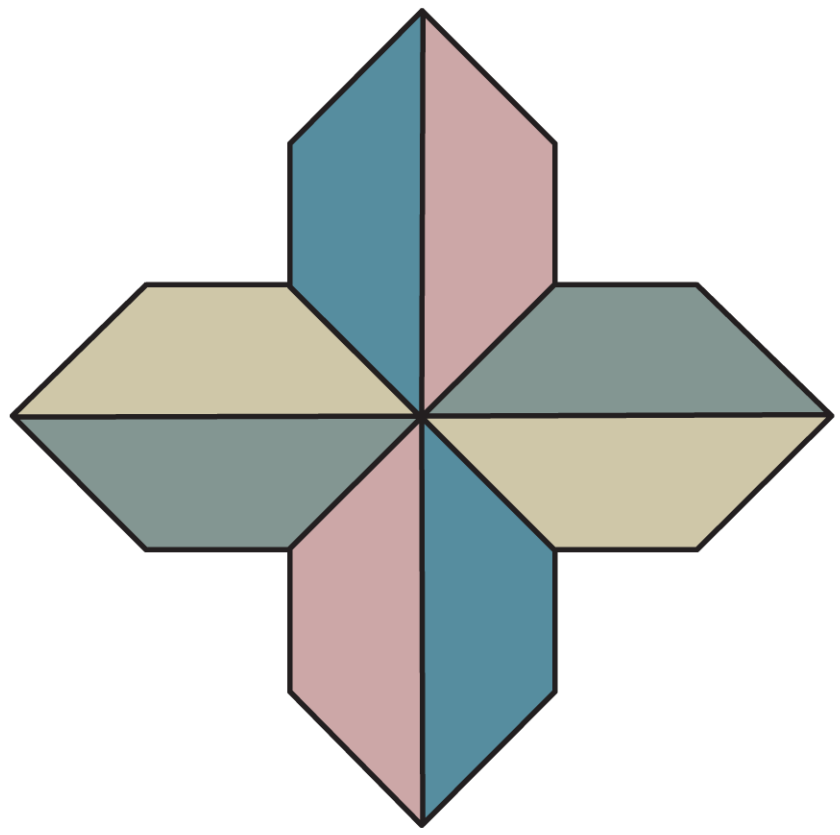


Trapezoids



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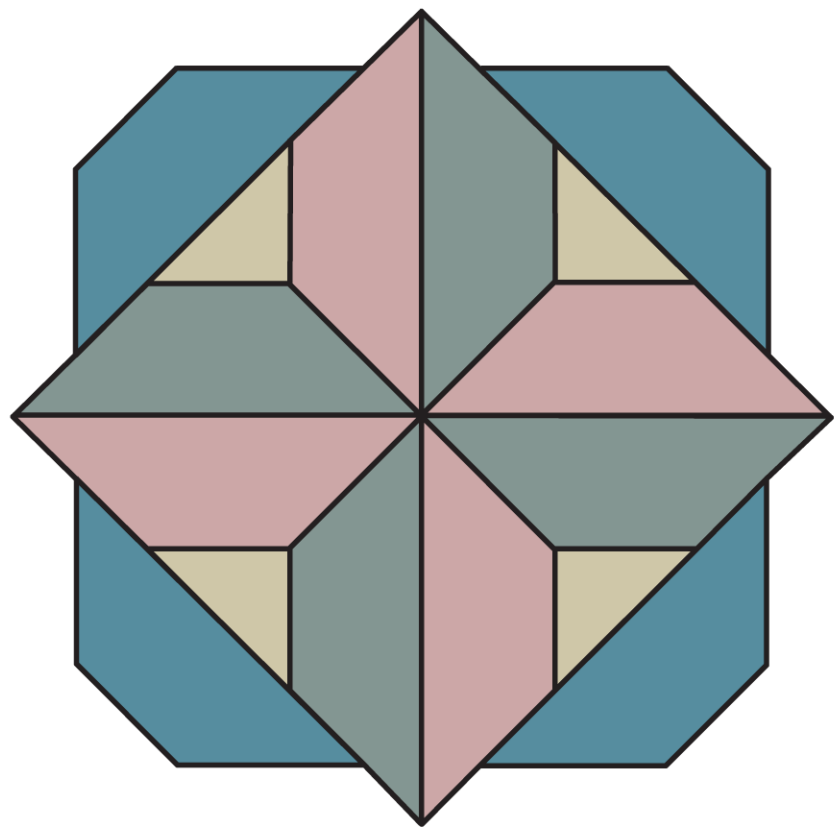

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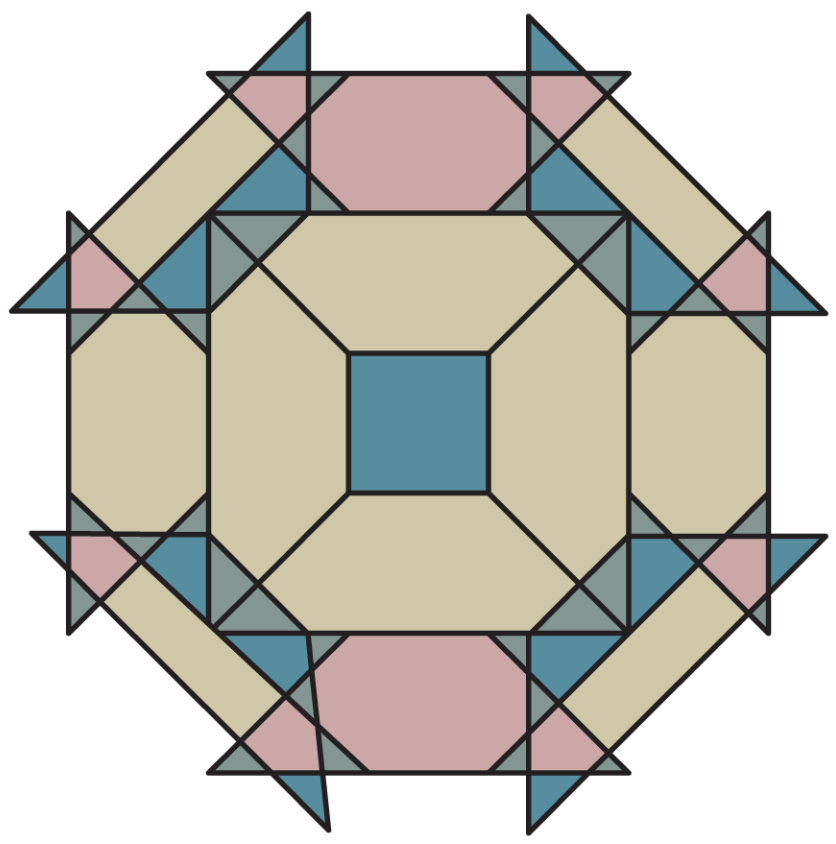

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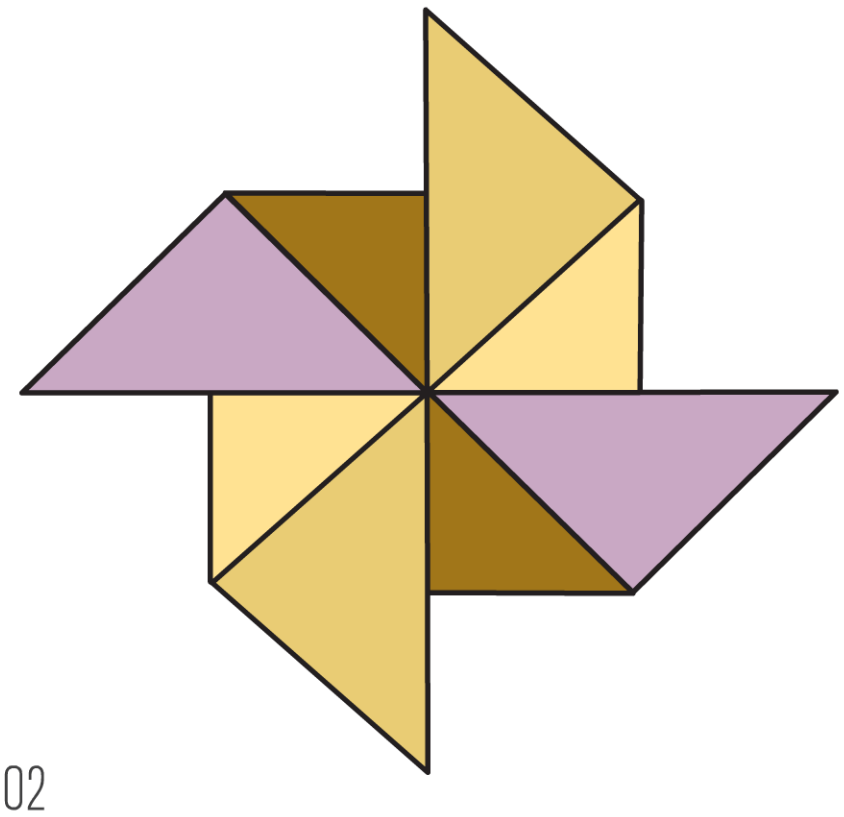

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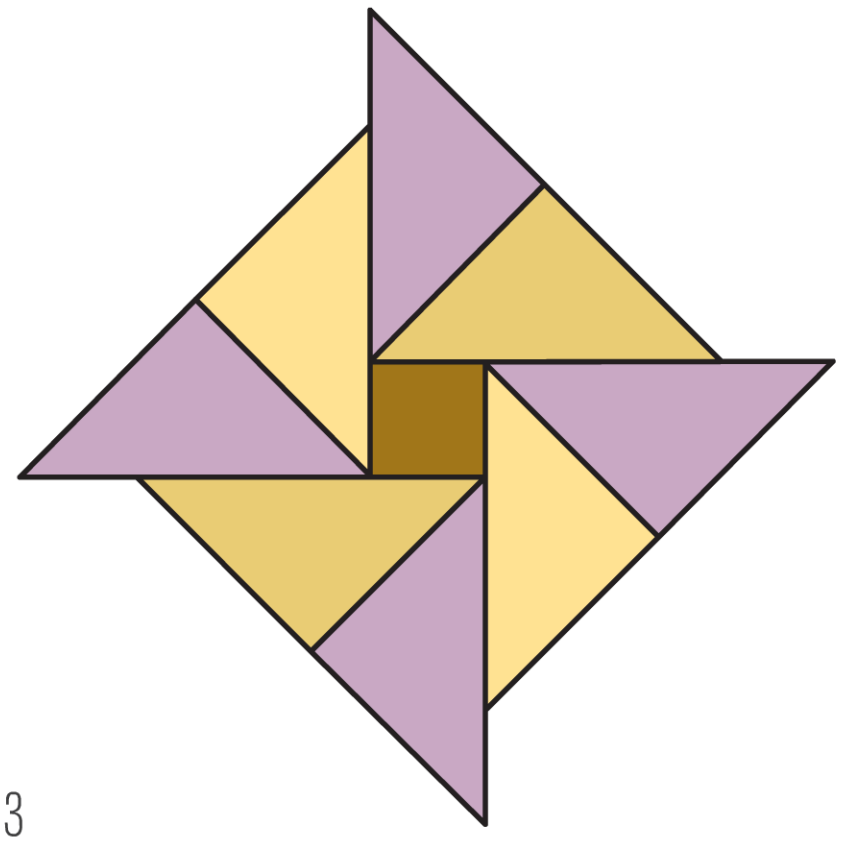

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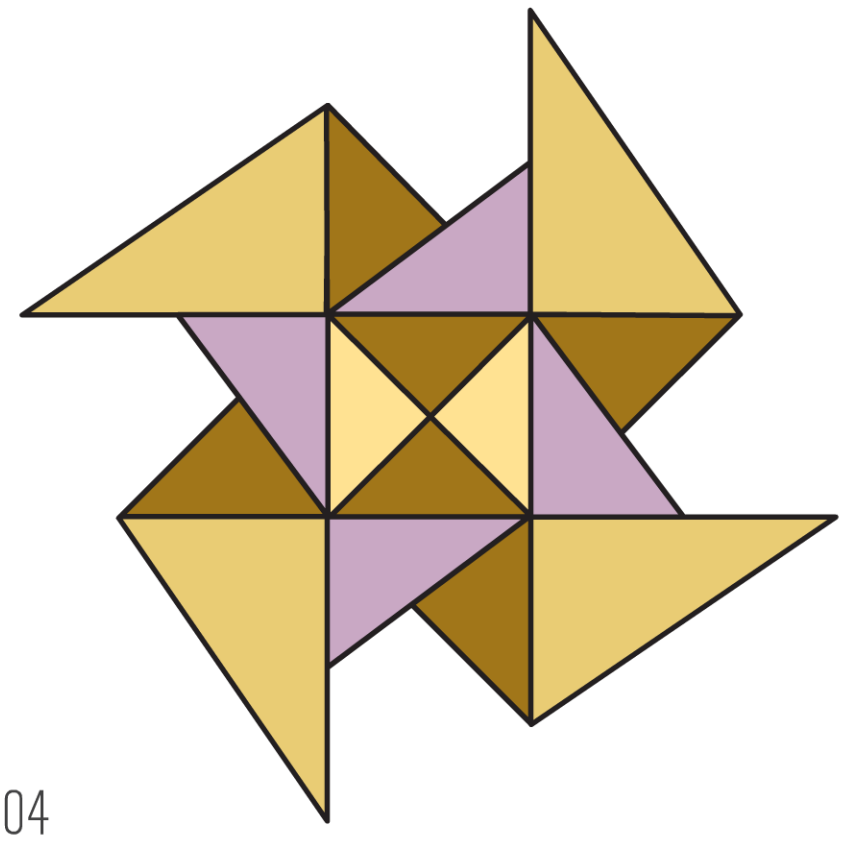

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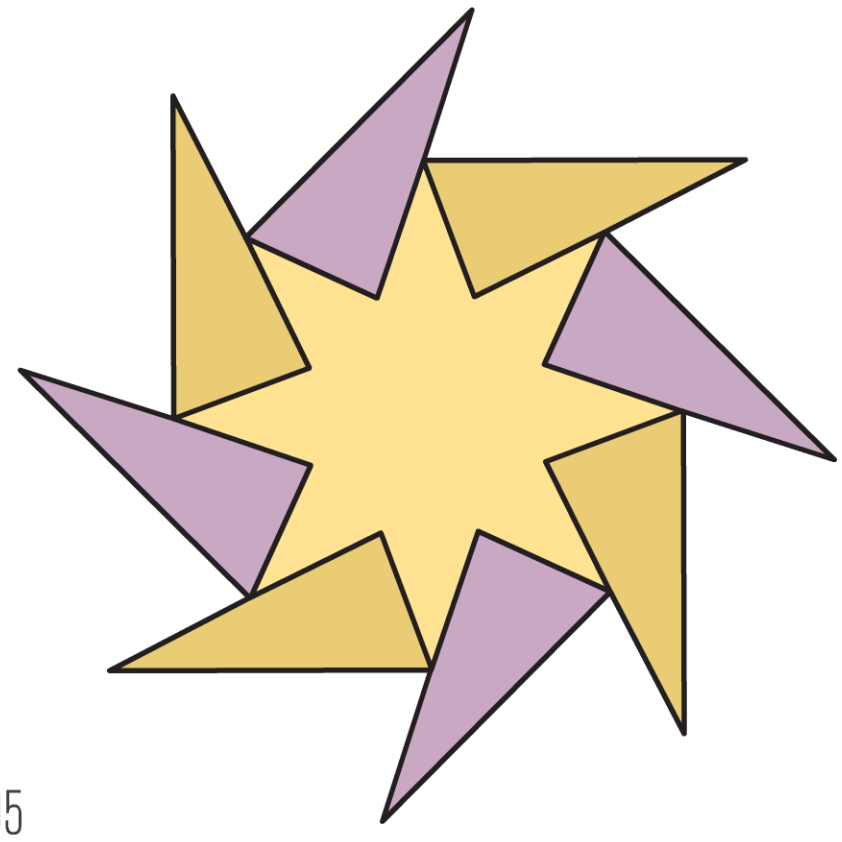

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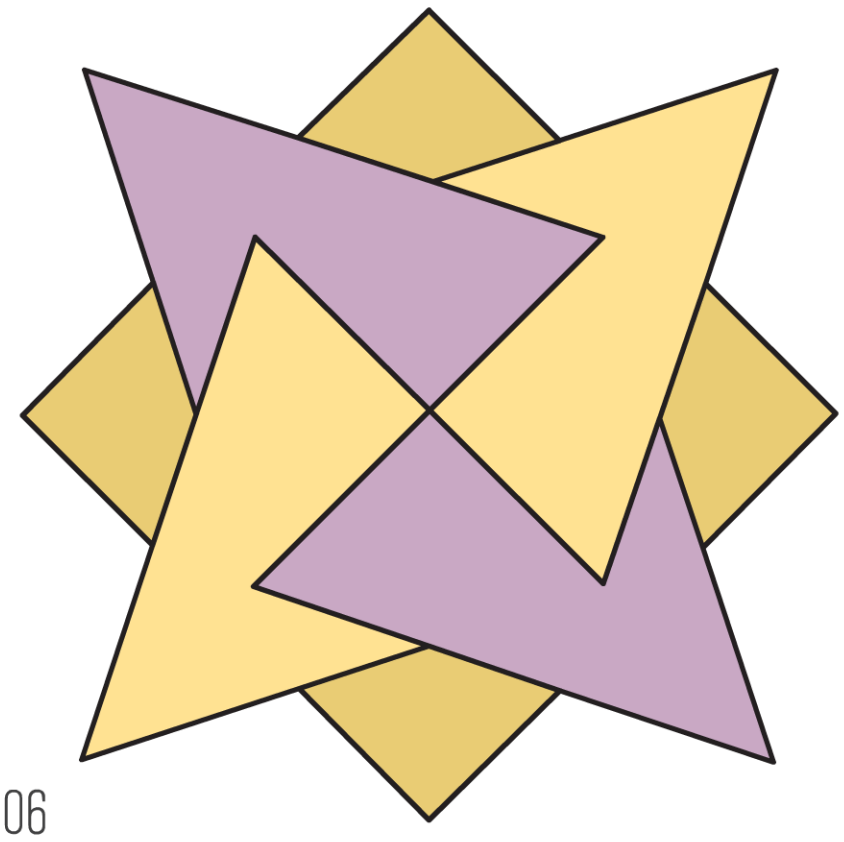

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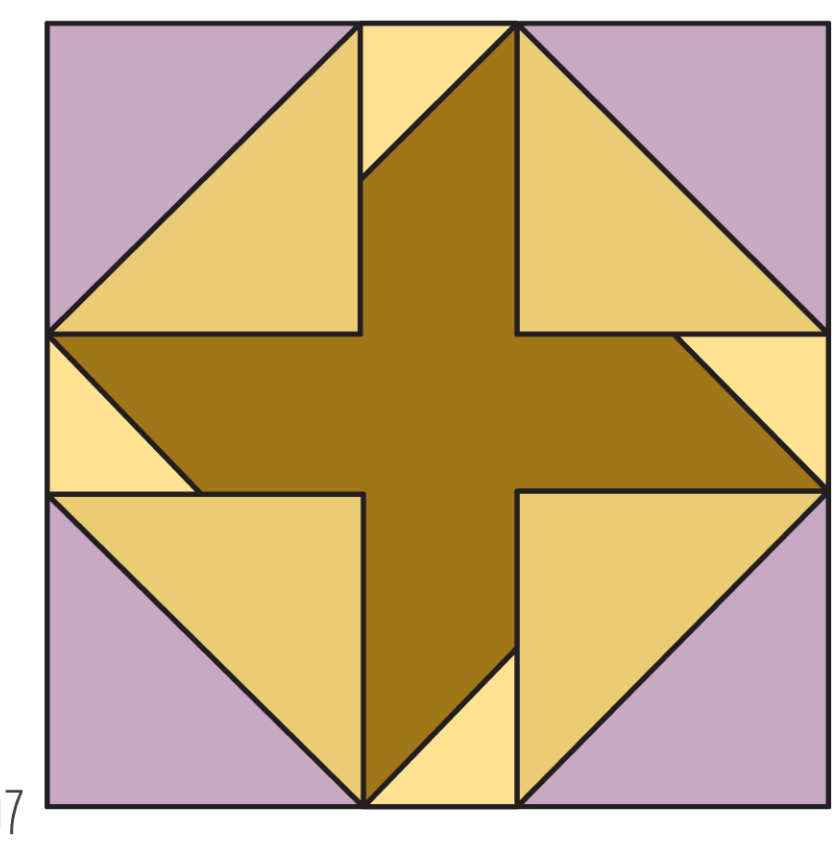

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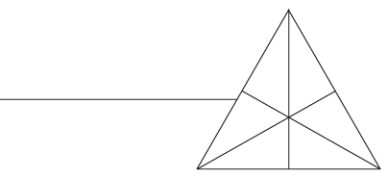

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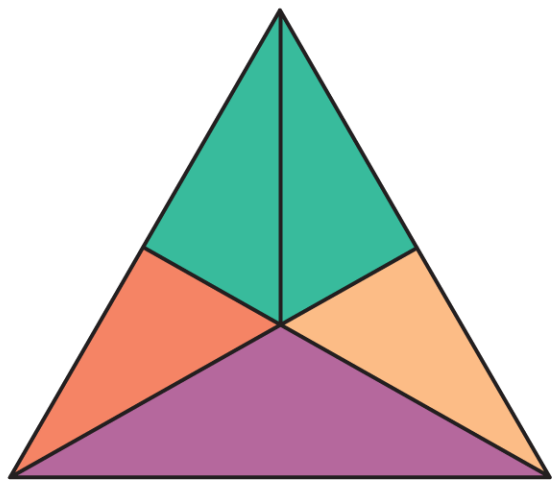

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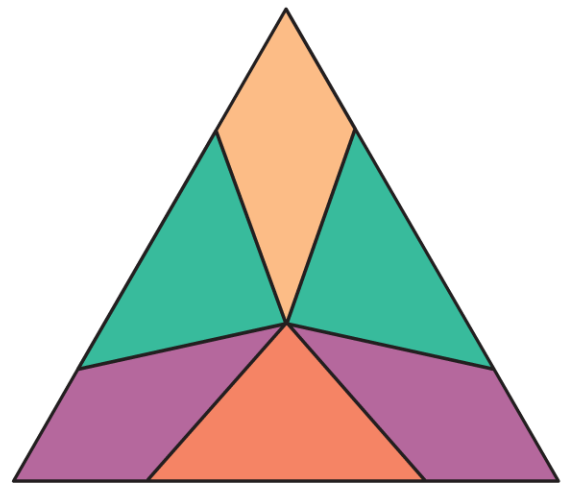

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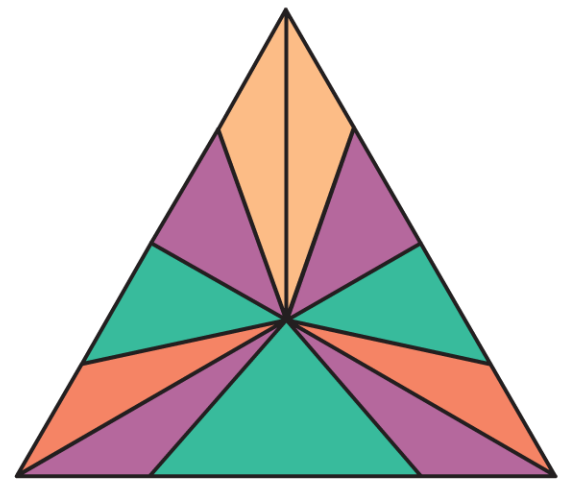

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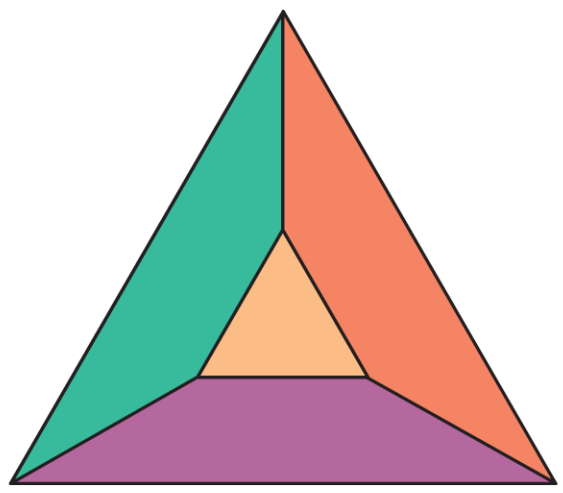

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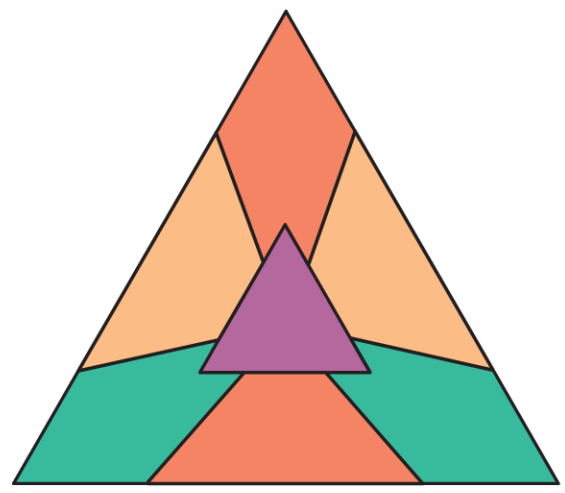

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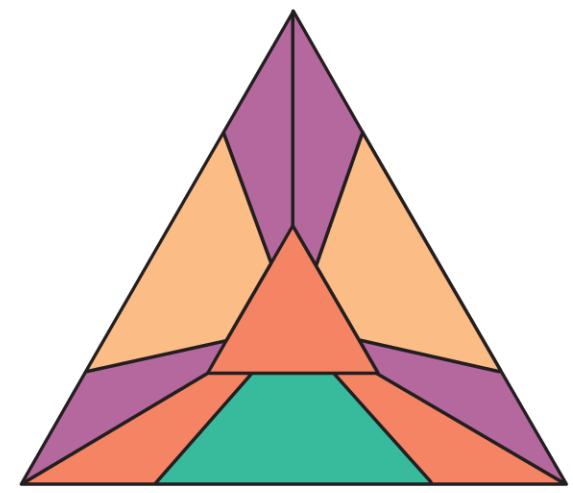

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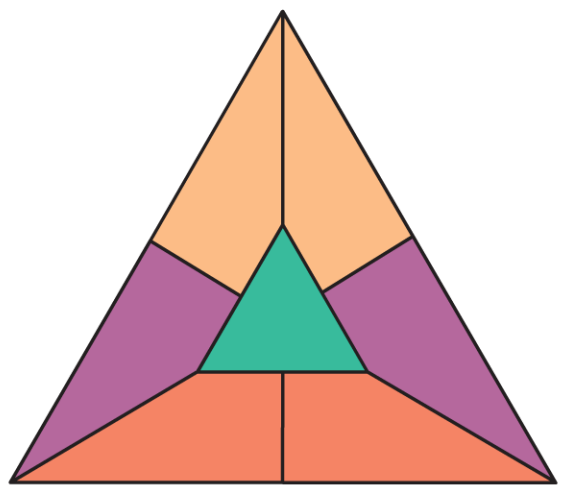

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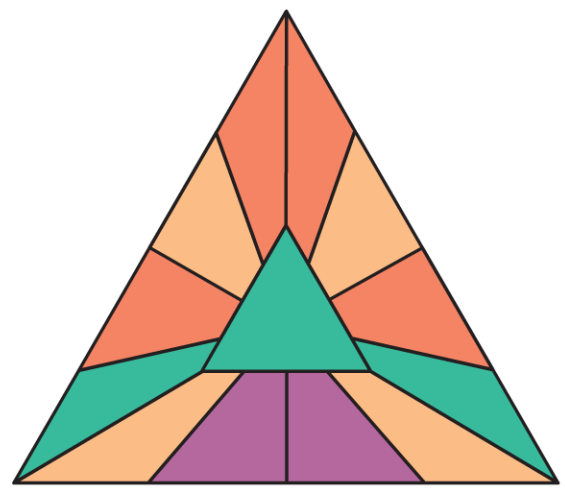

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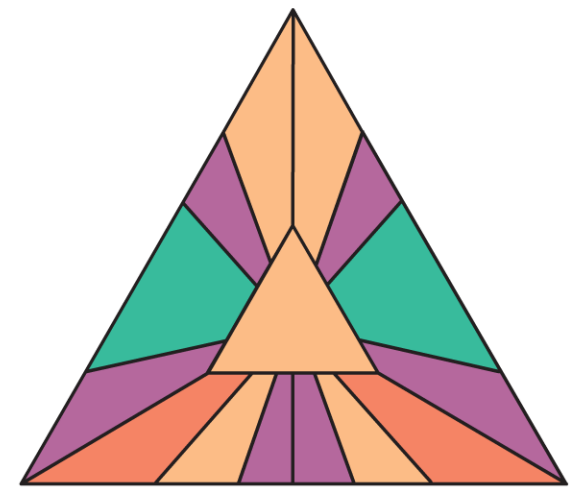

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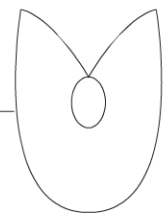

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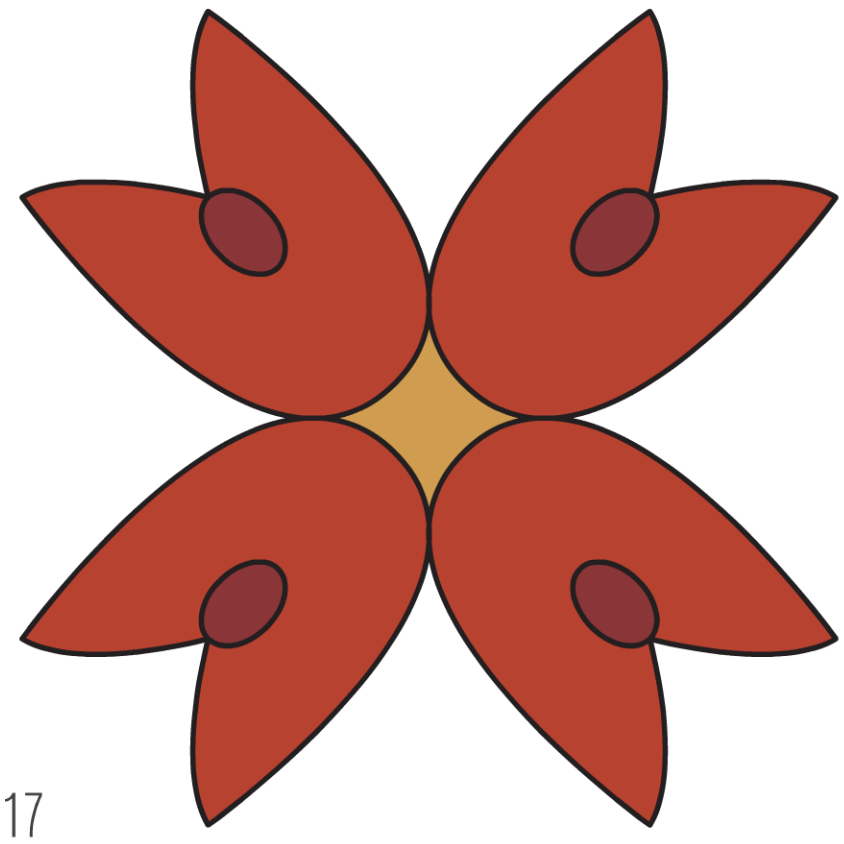

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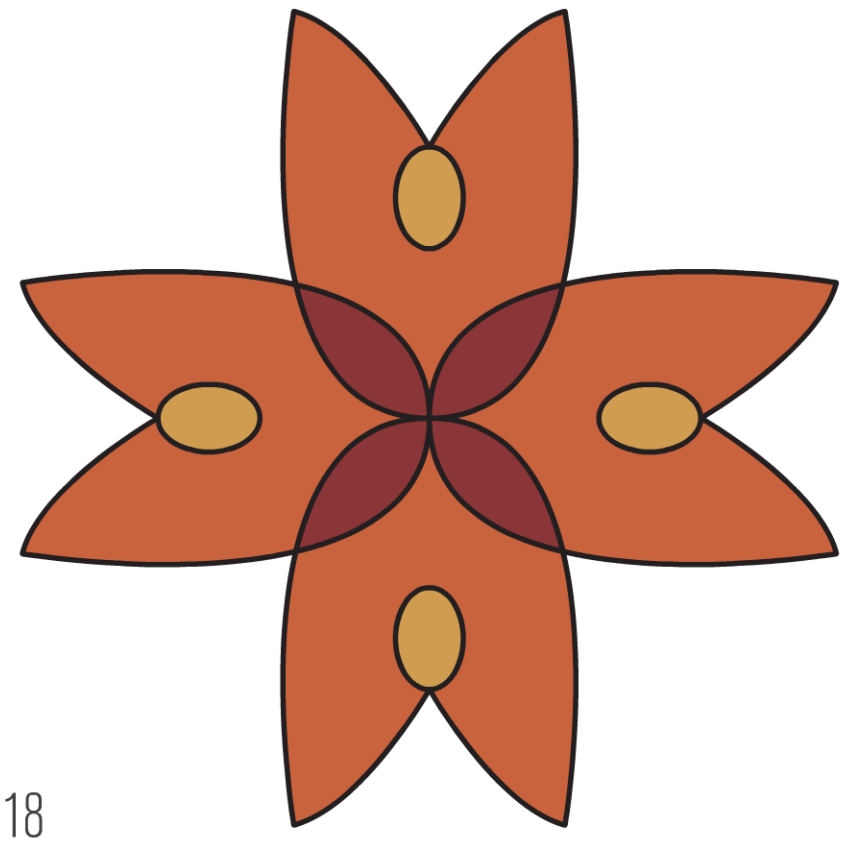

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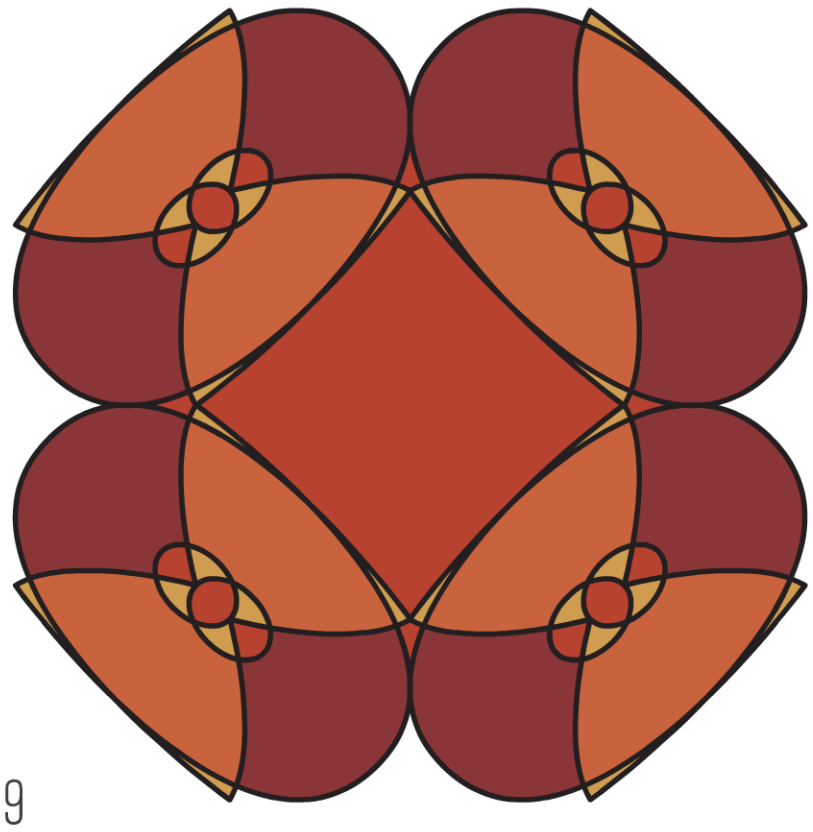

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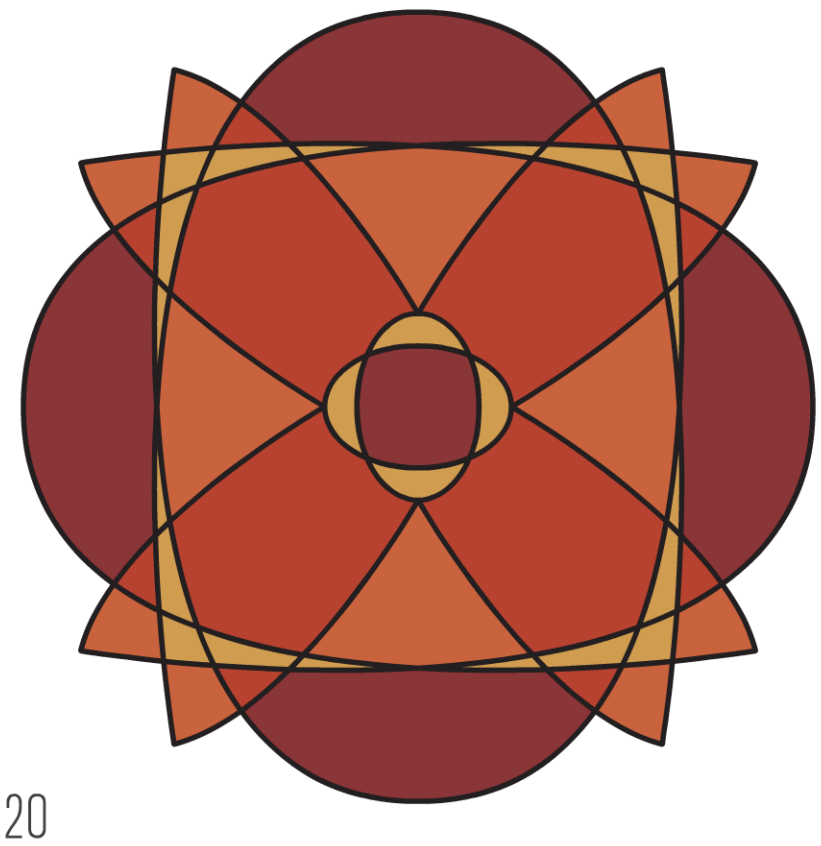

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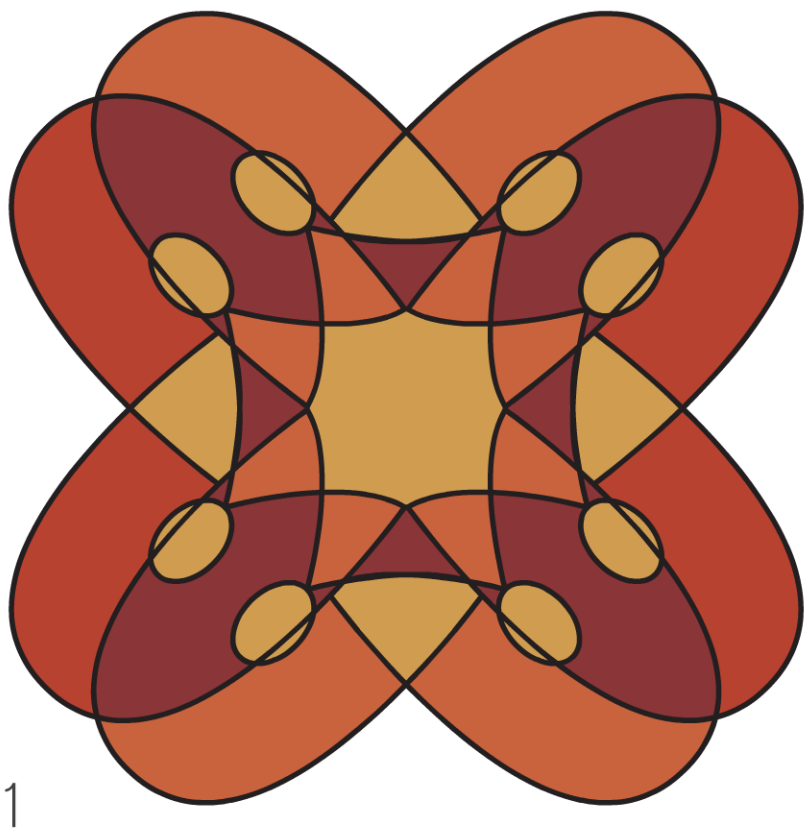

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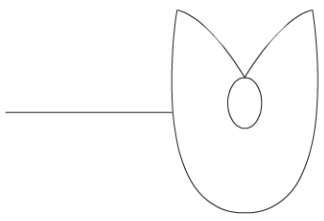

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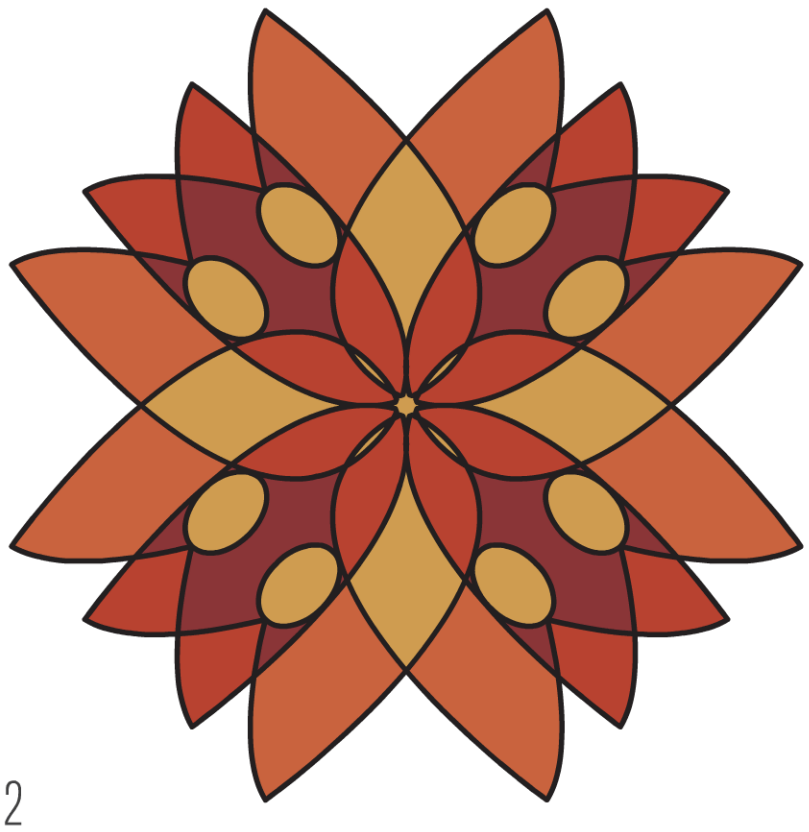

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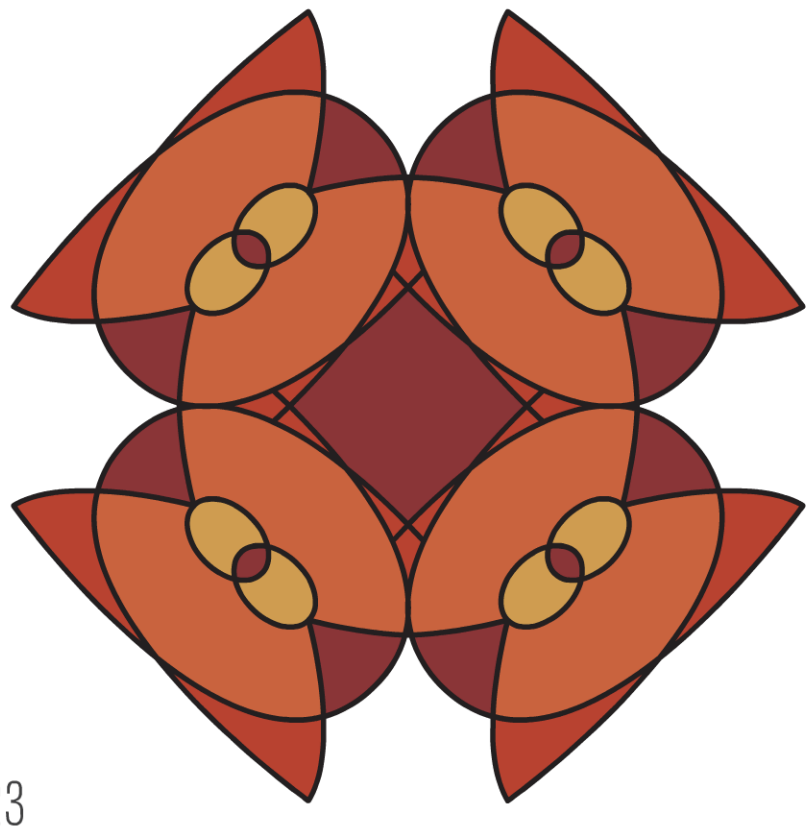

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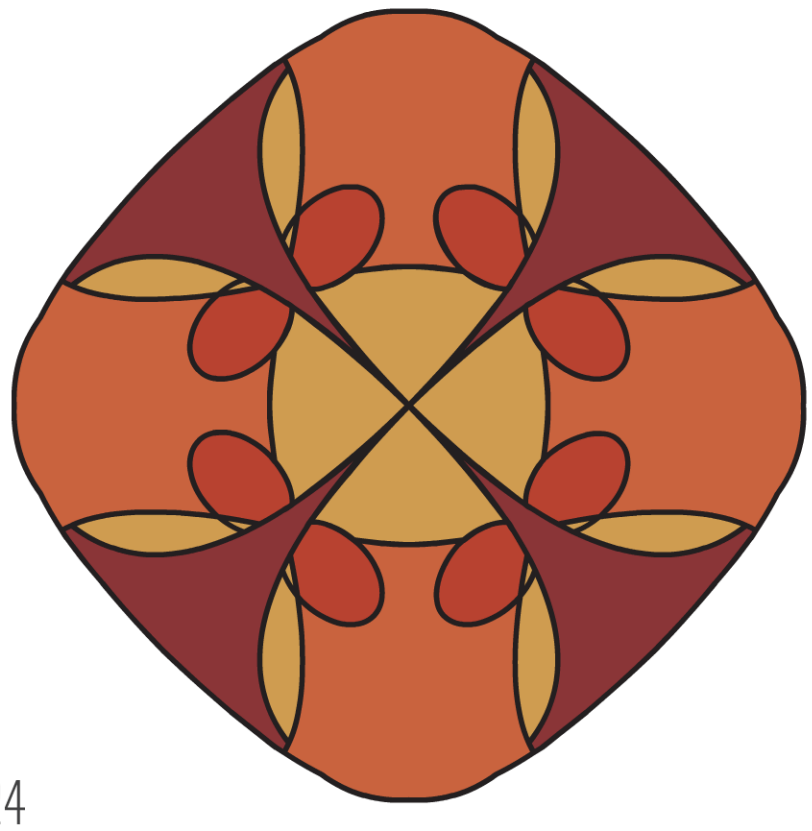

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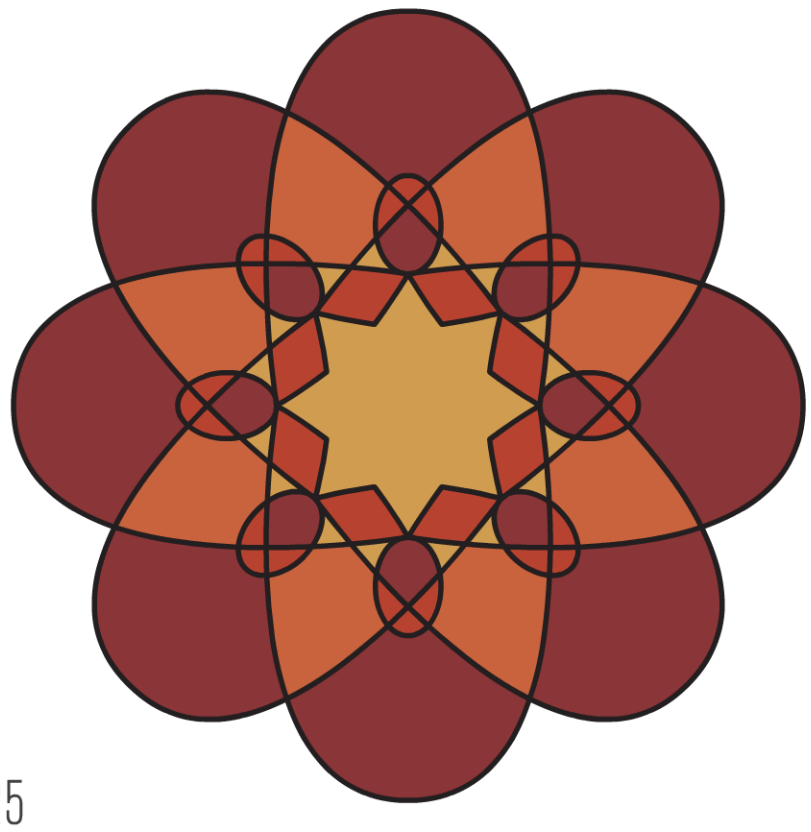

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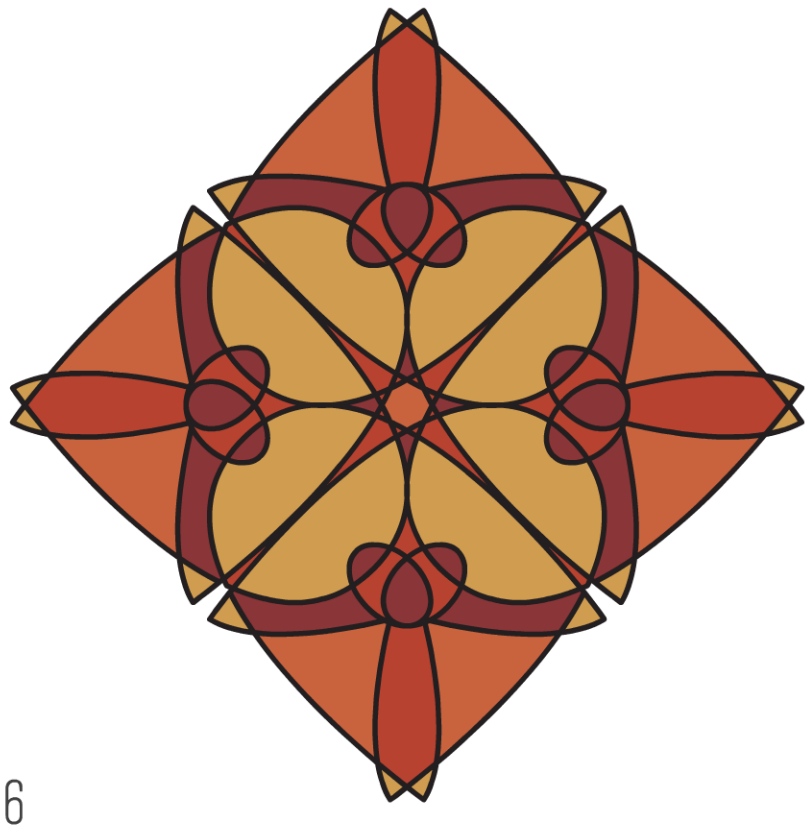

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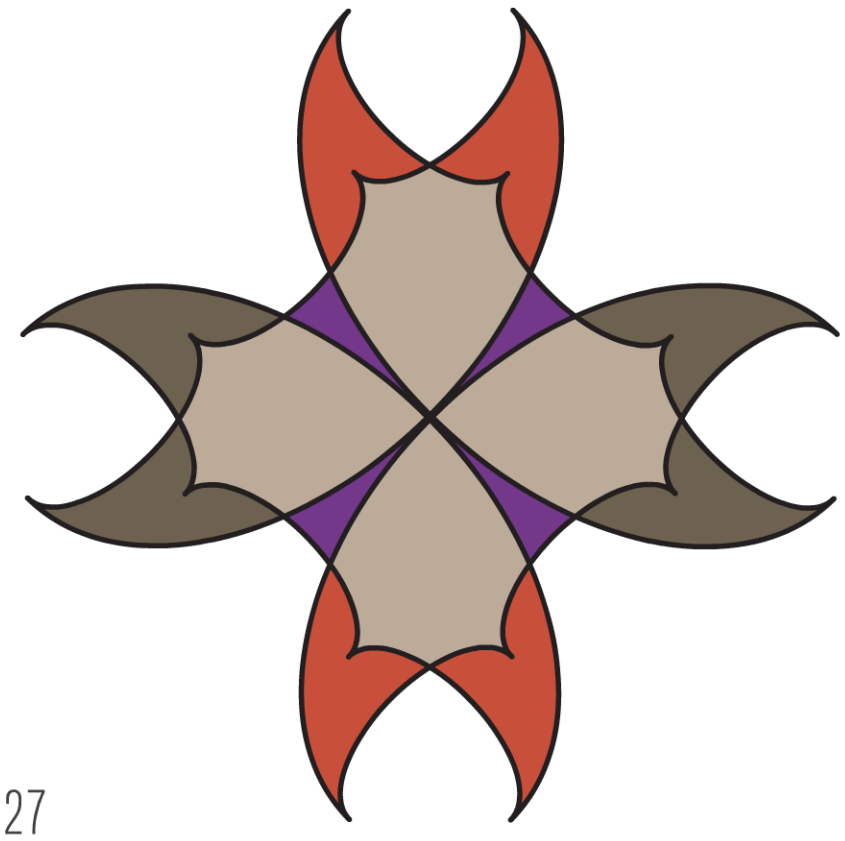
Umbrellas



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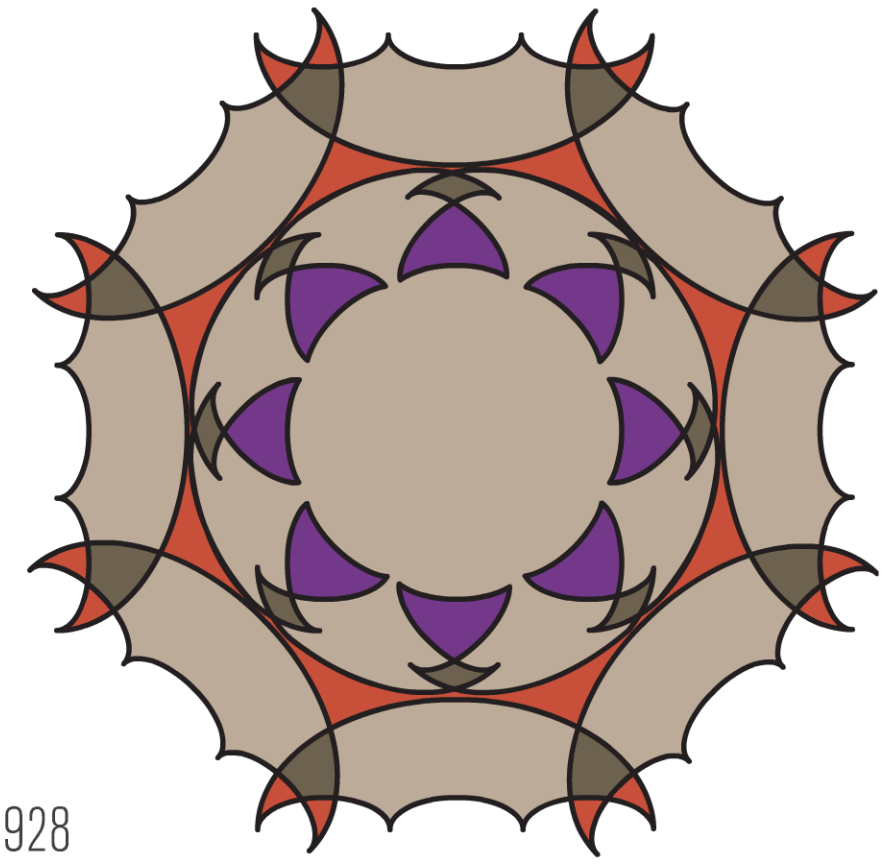

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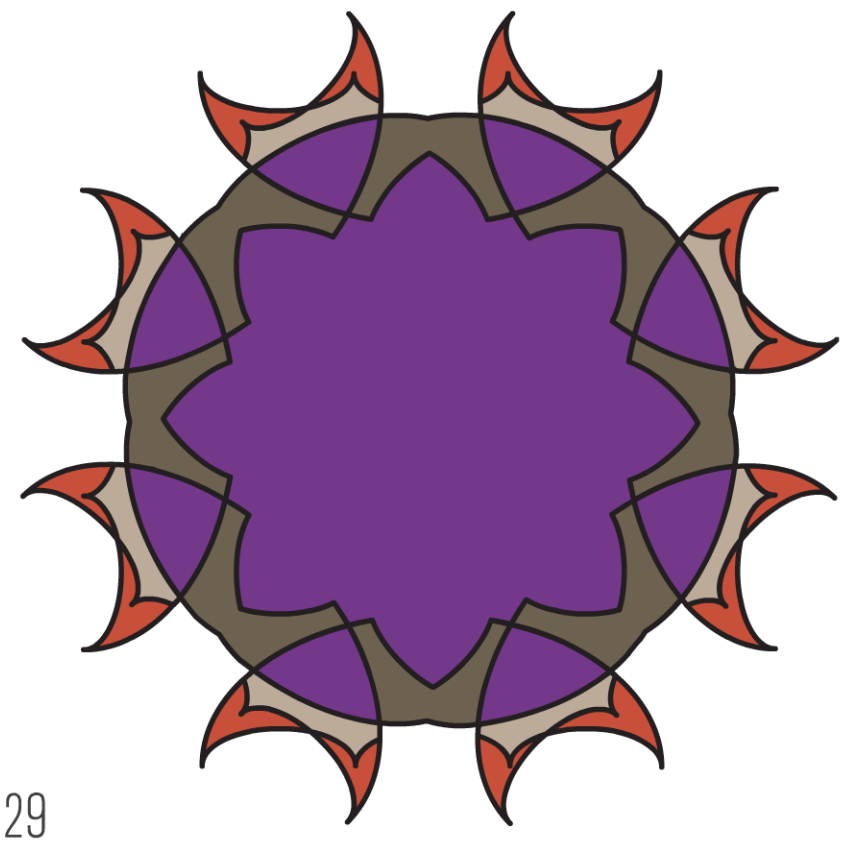

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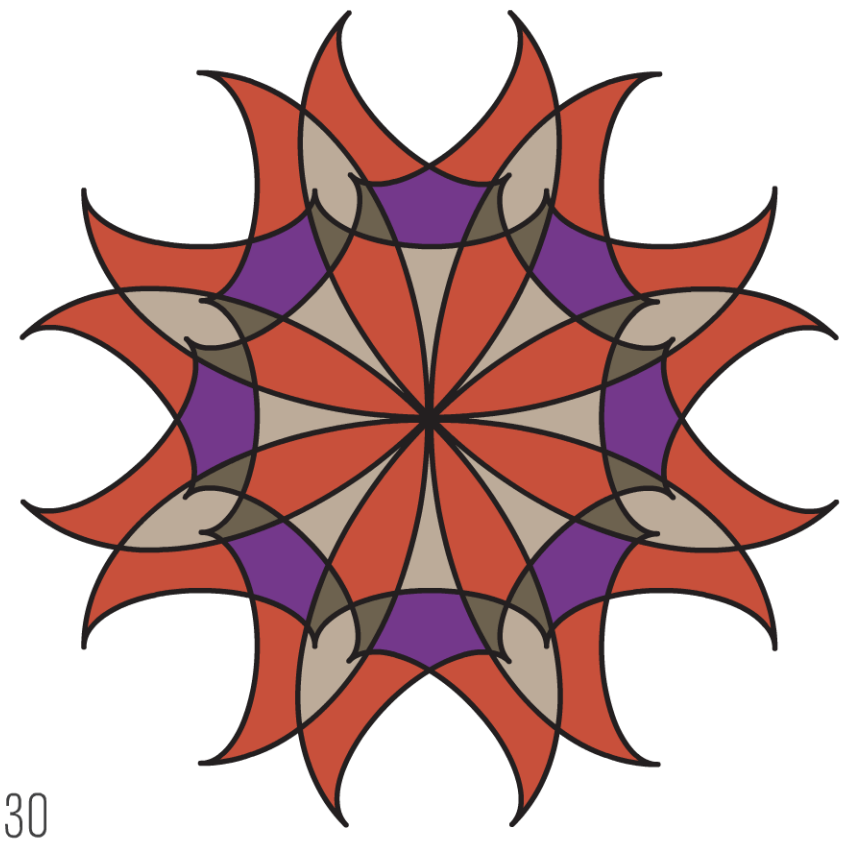

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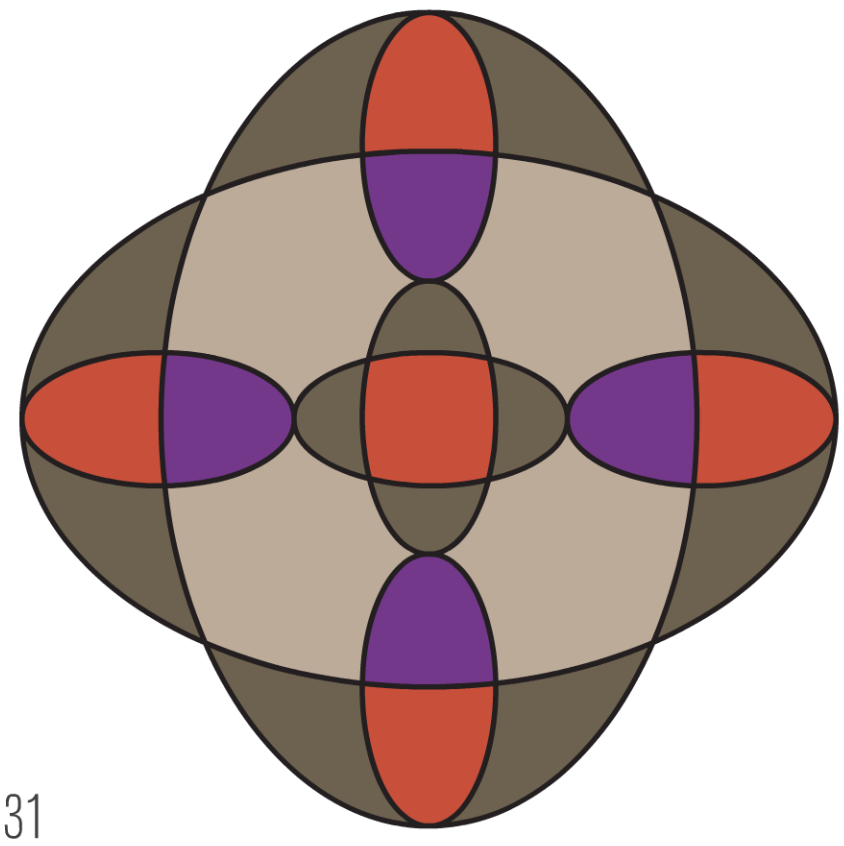

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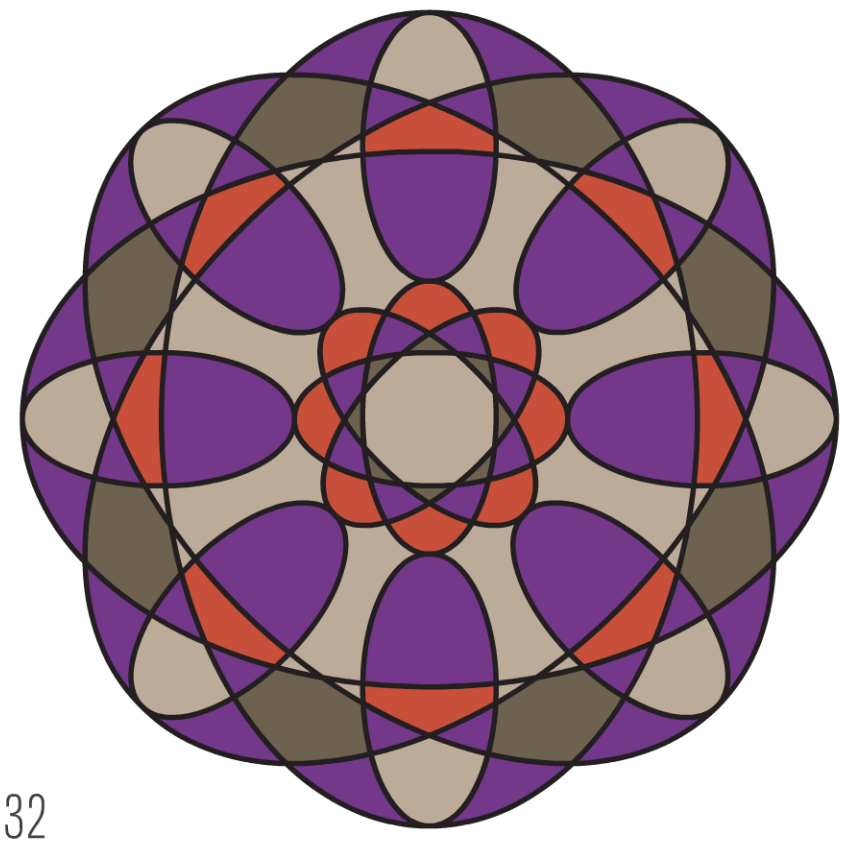

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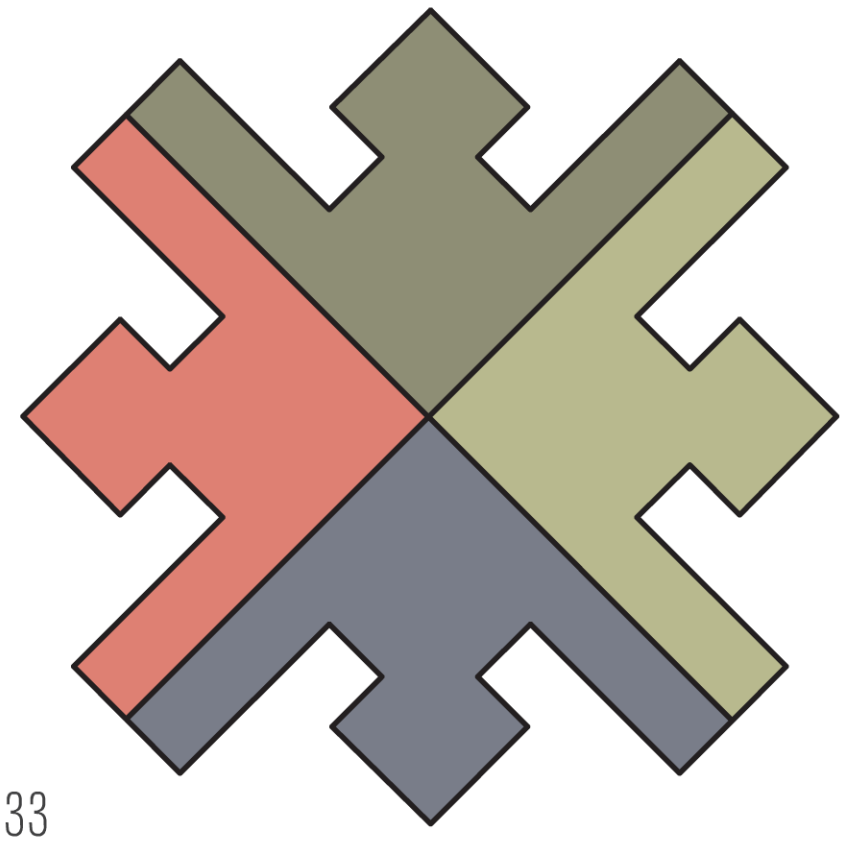
Up at Arms



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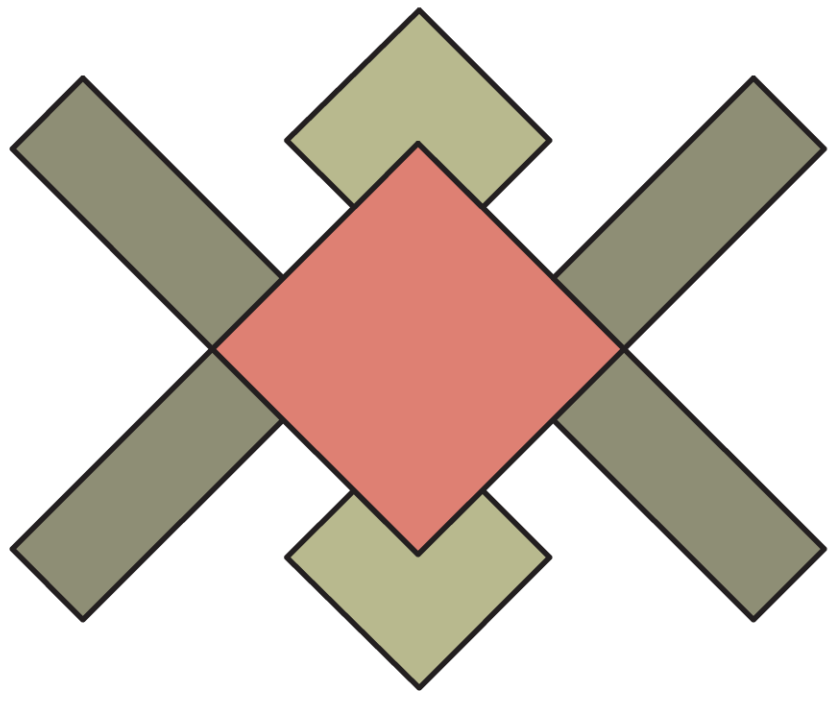

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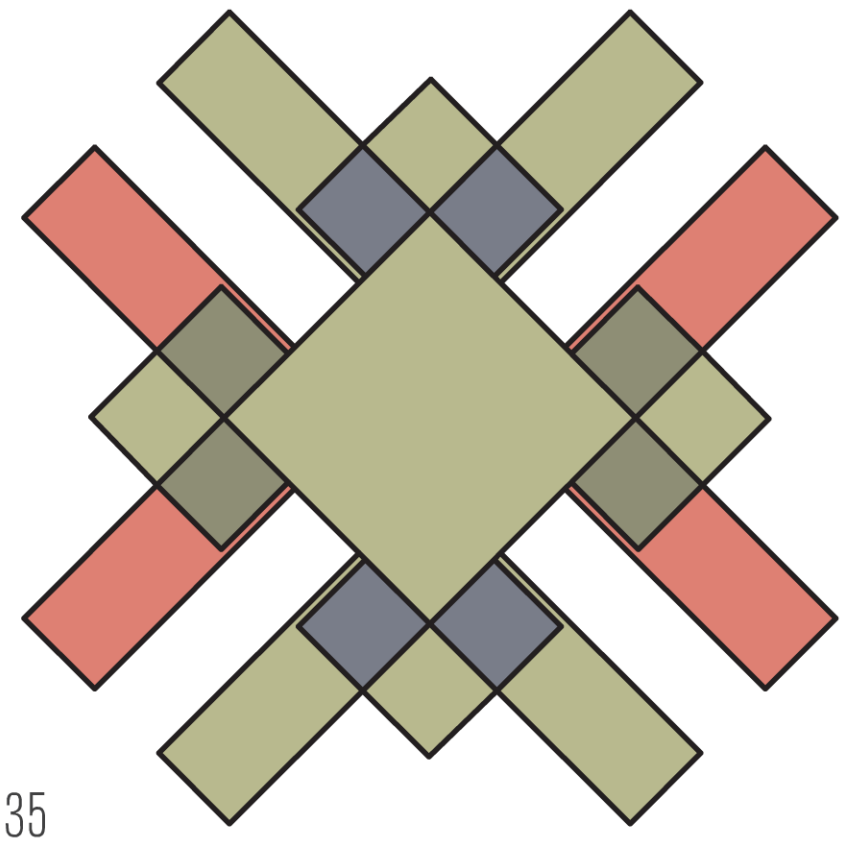

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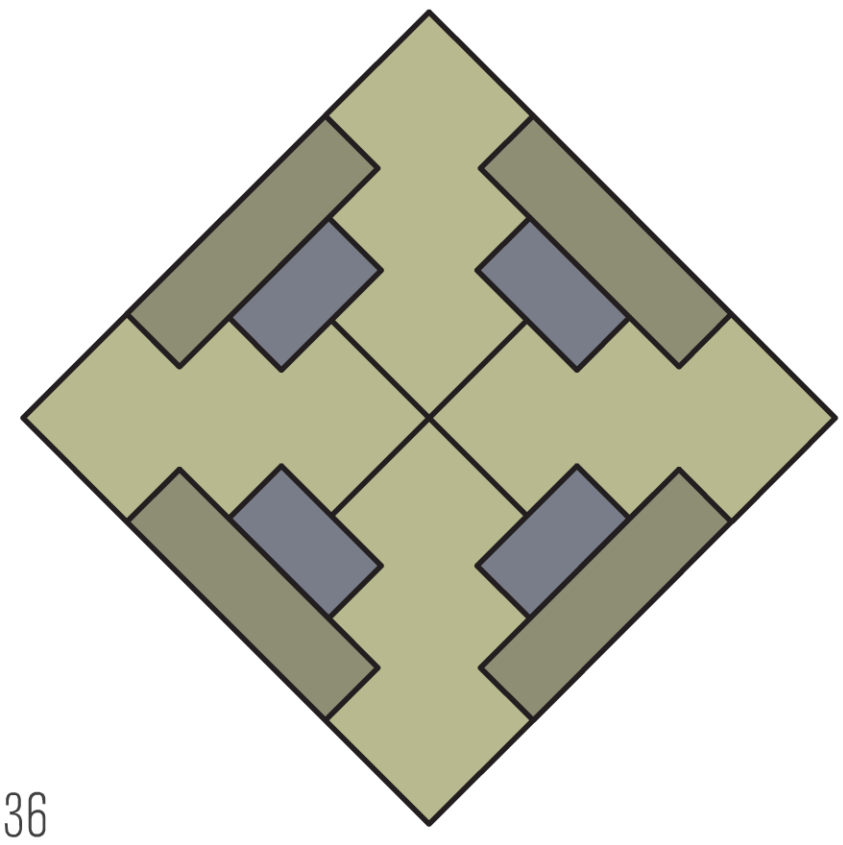

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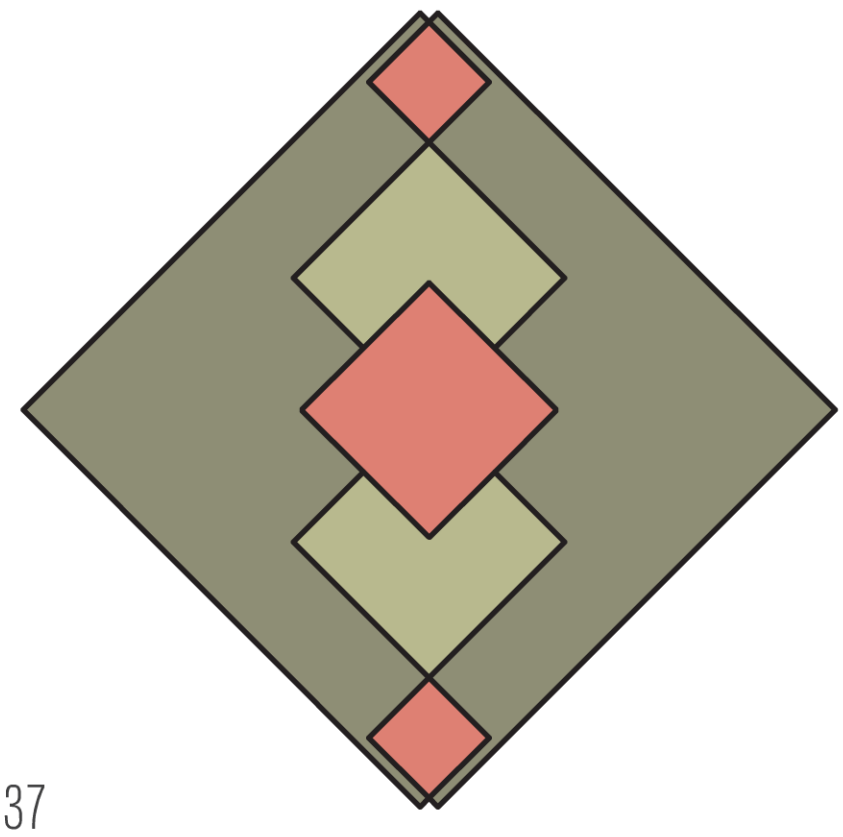

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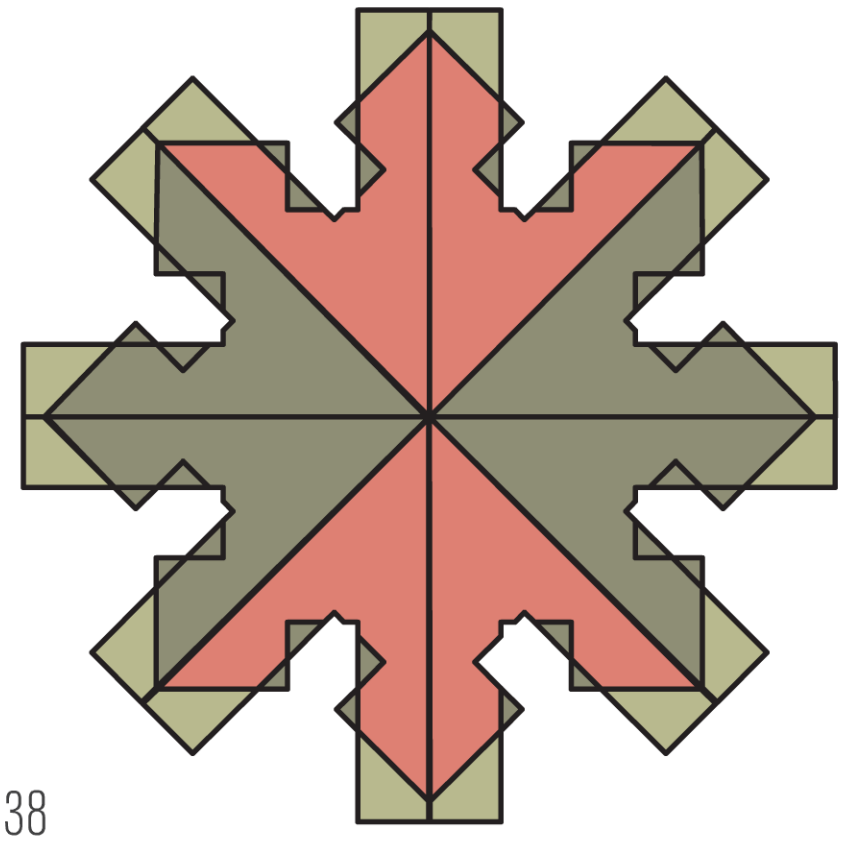

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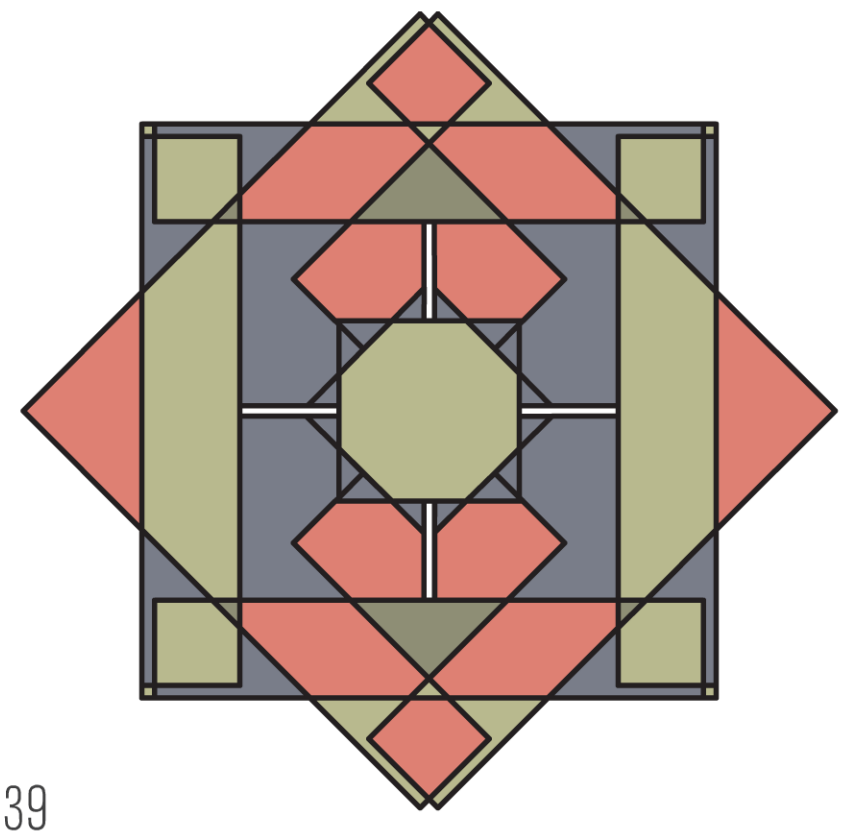

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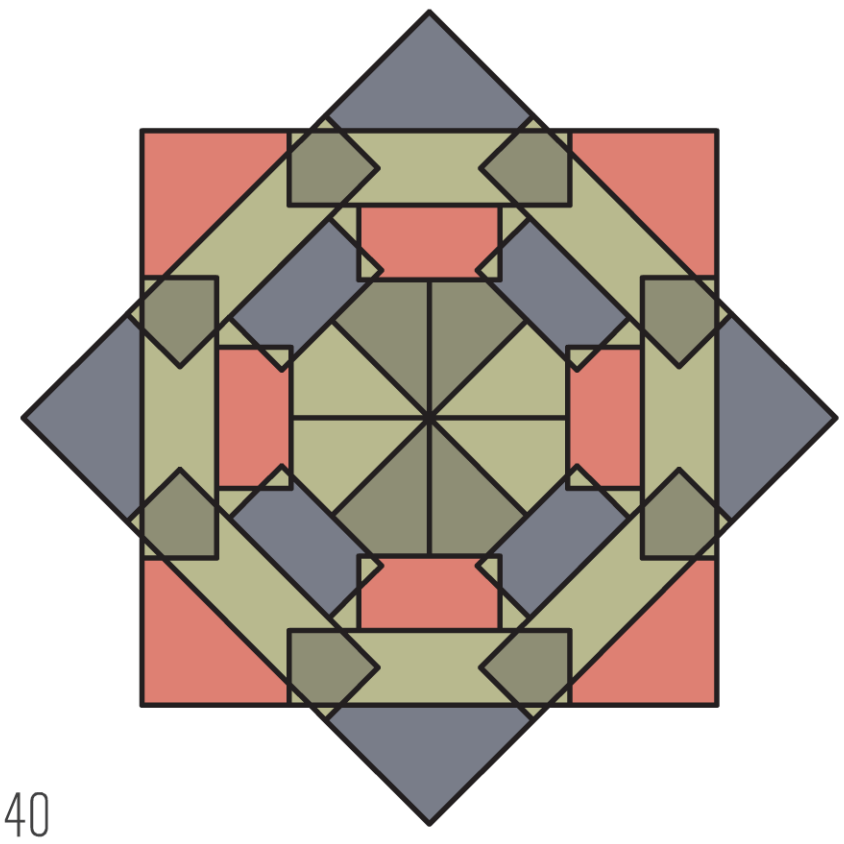

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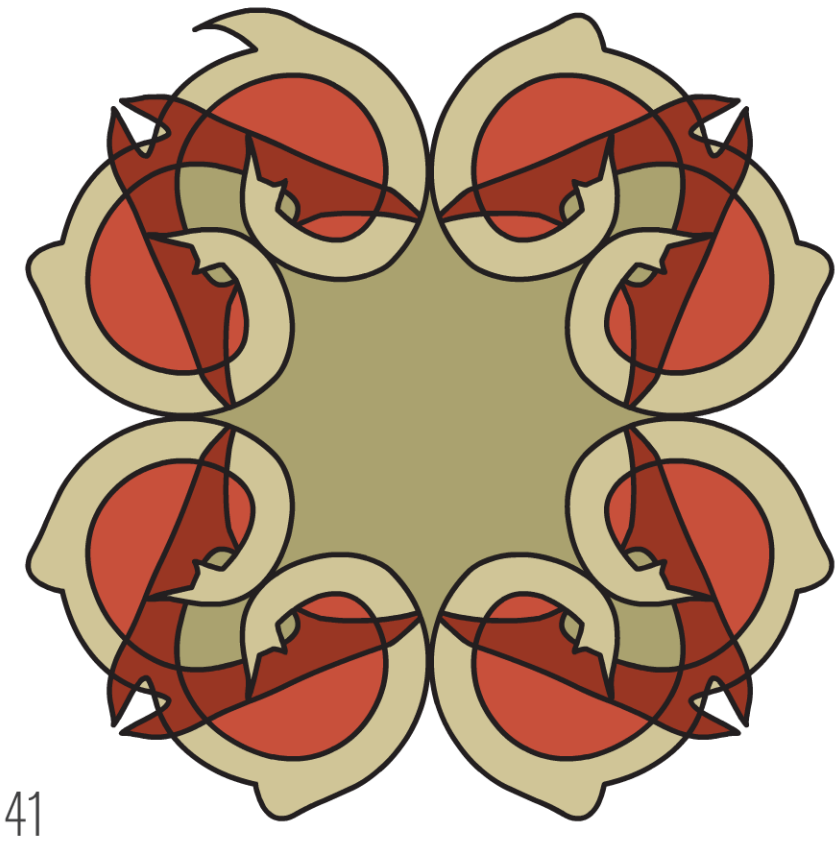
Vine Leaf



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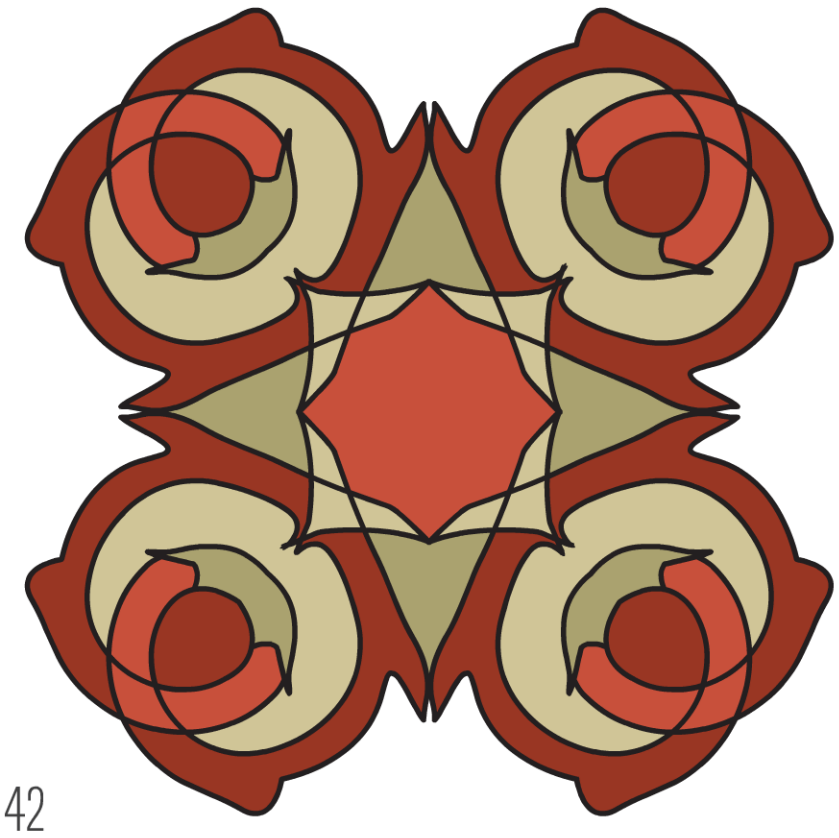

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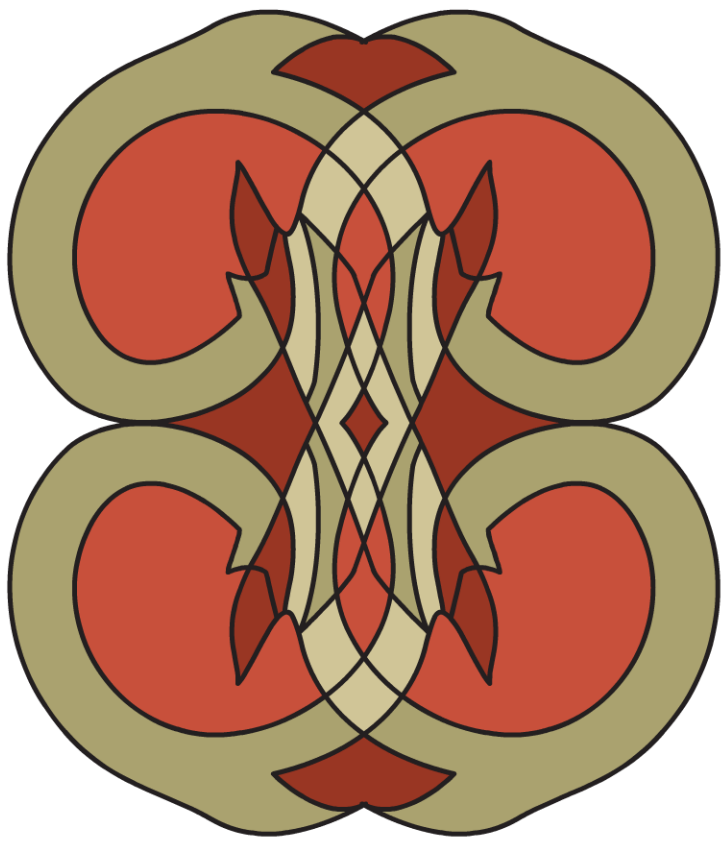

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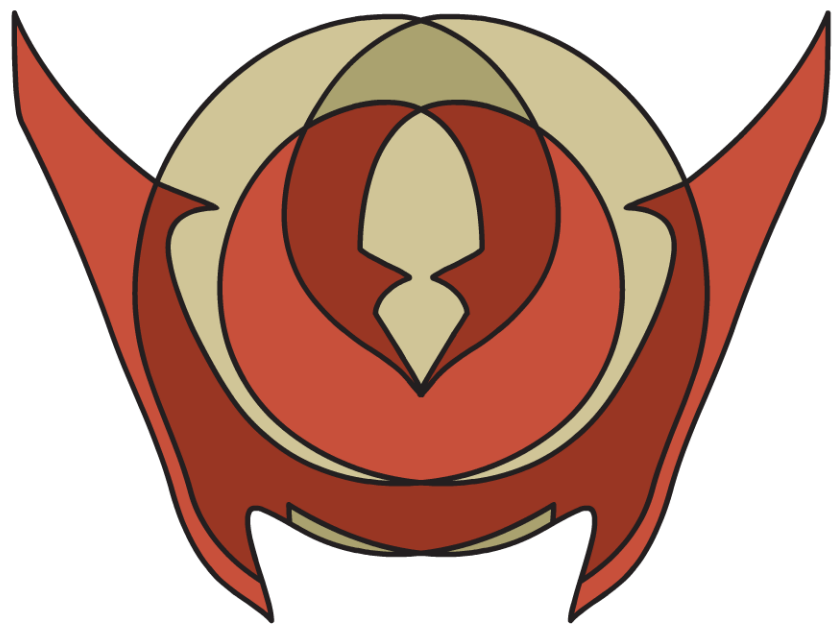

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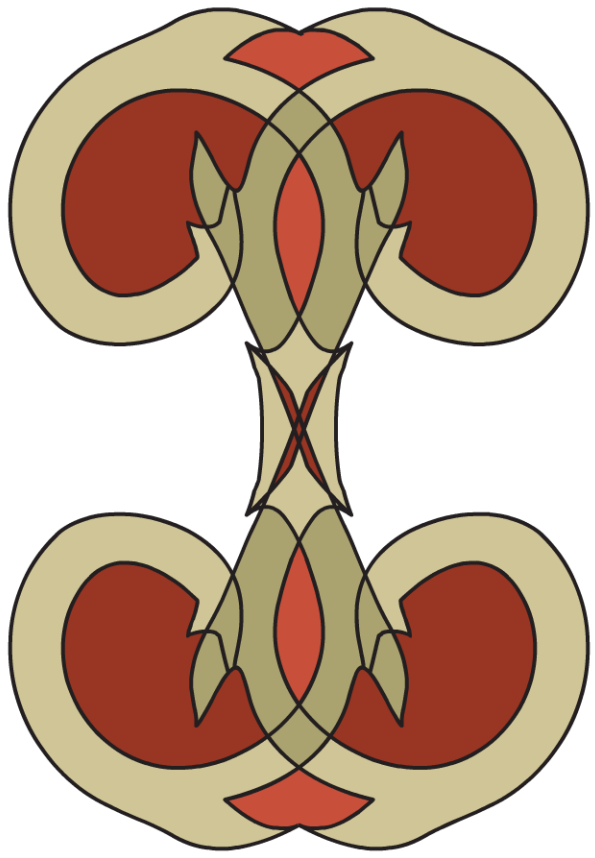

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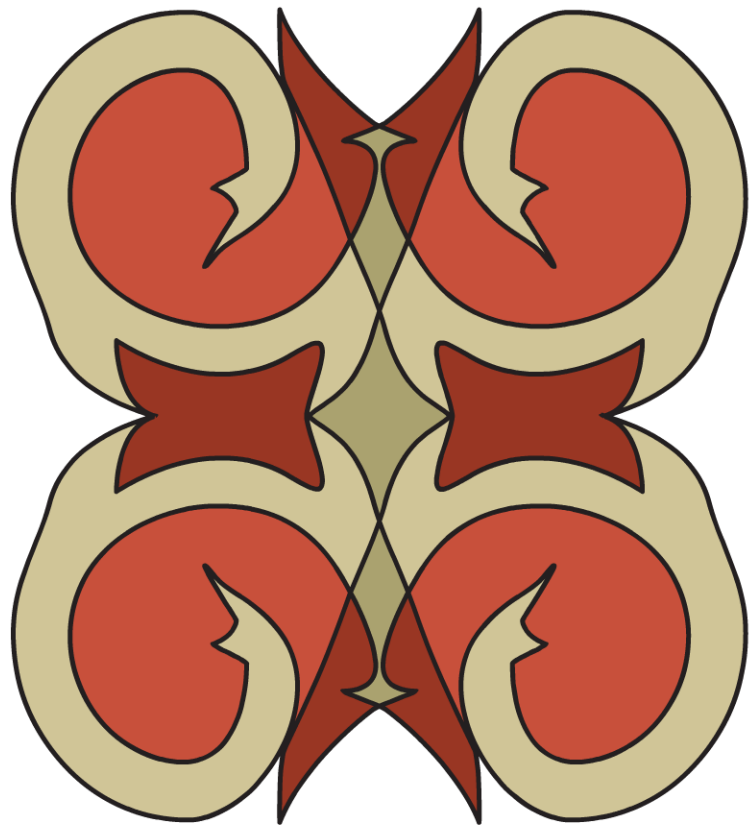

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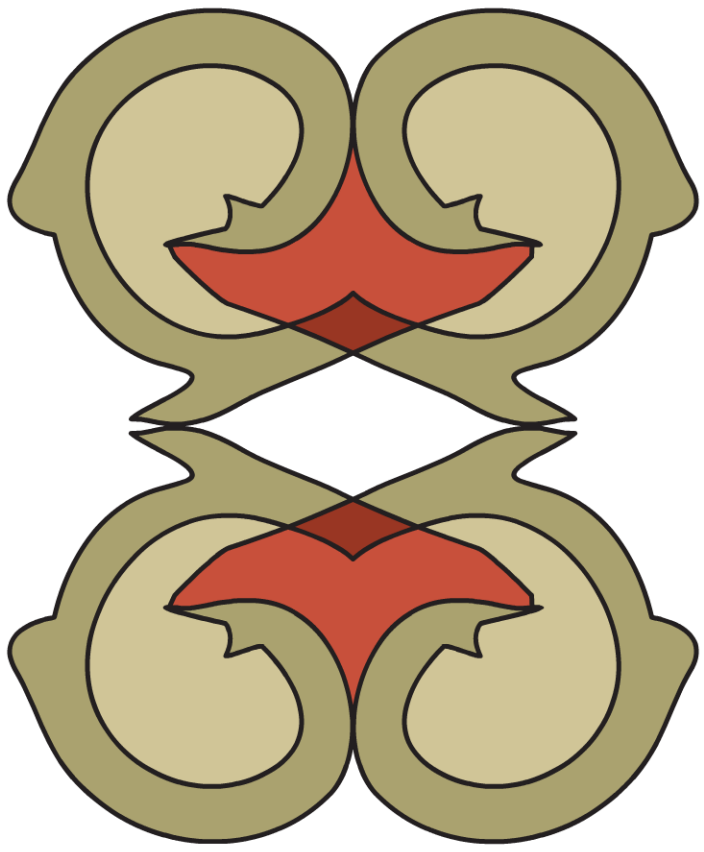

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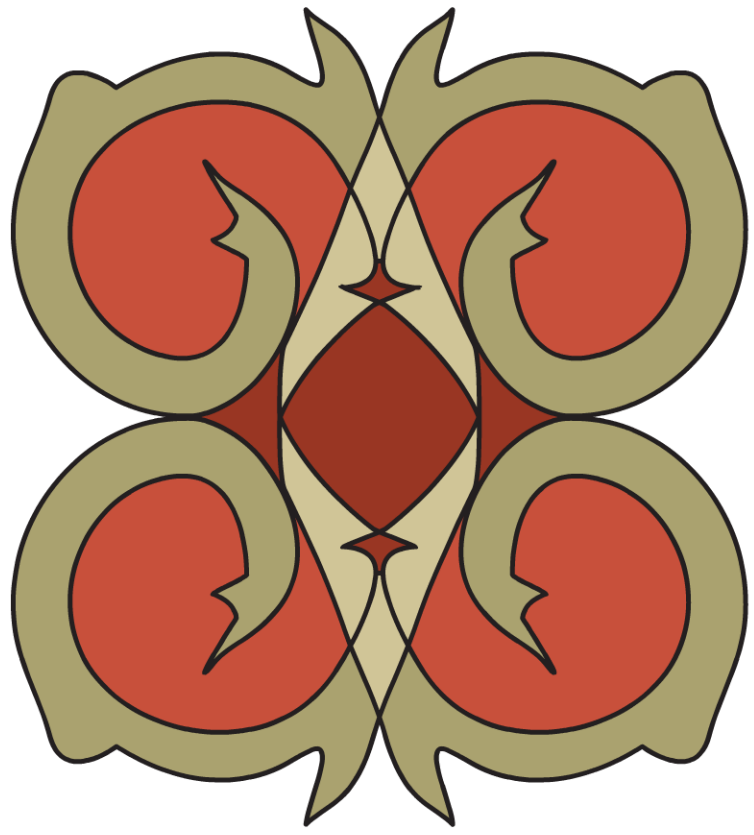

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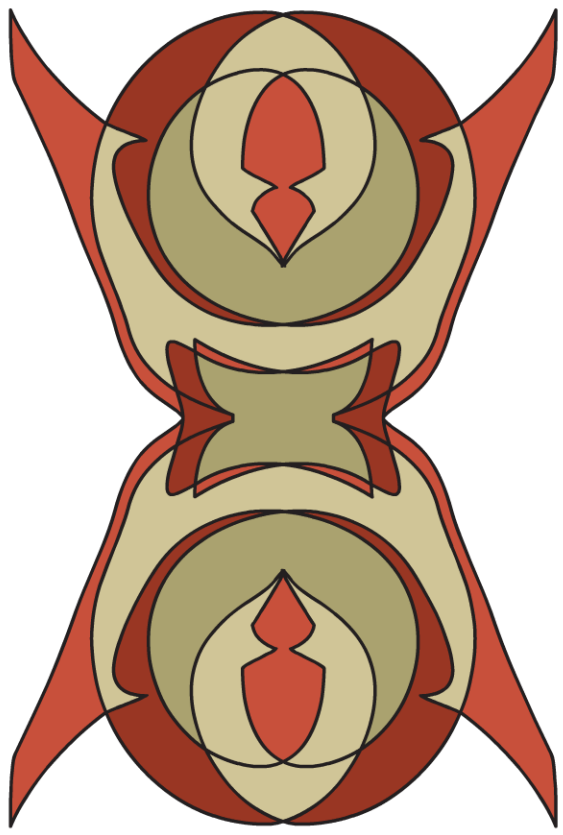

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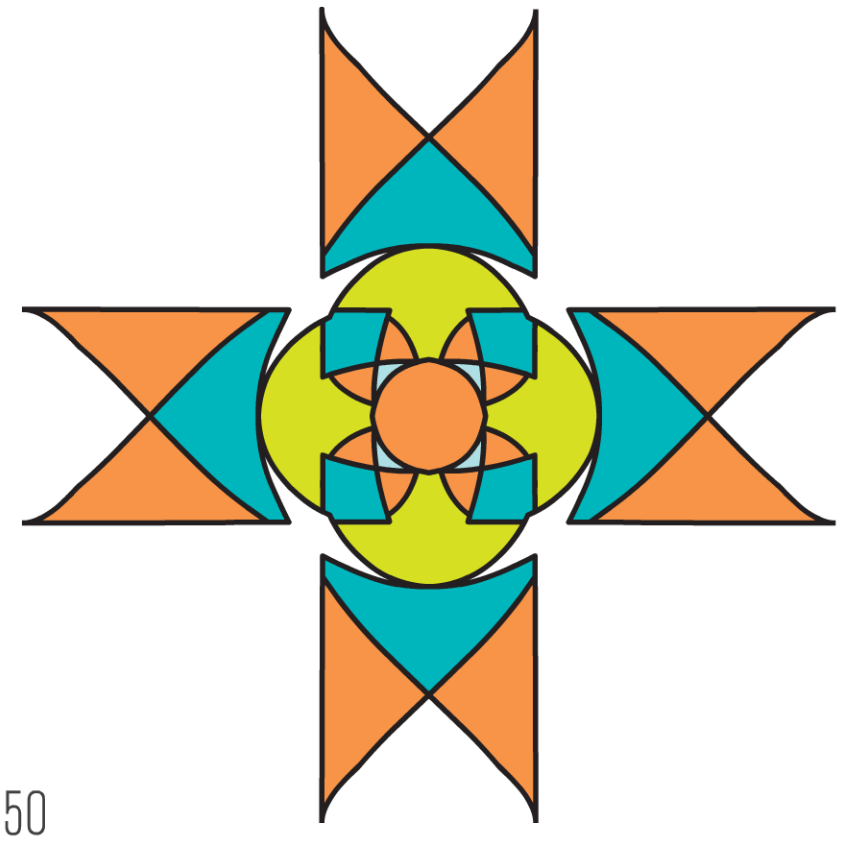
Waves



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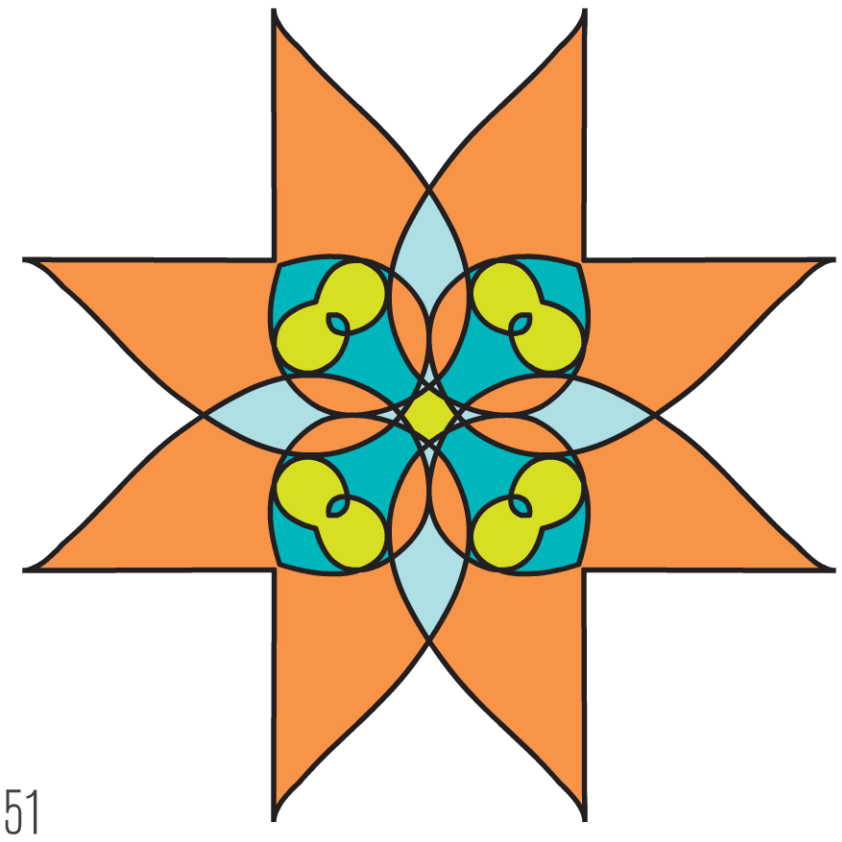

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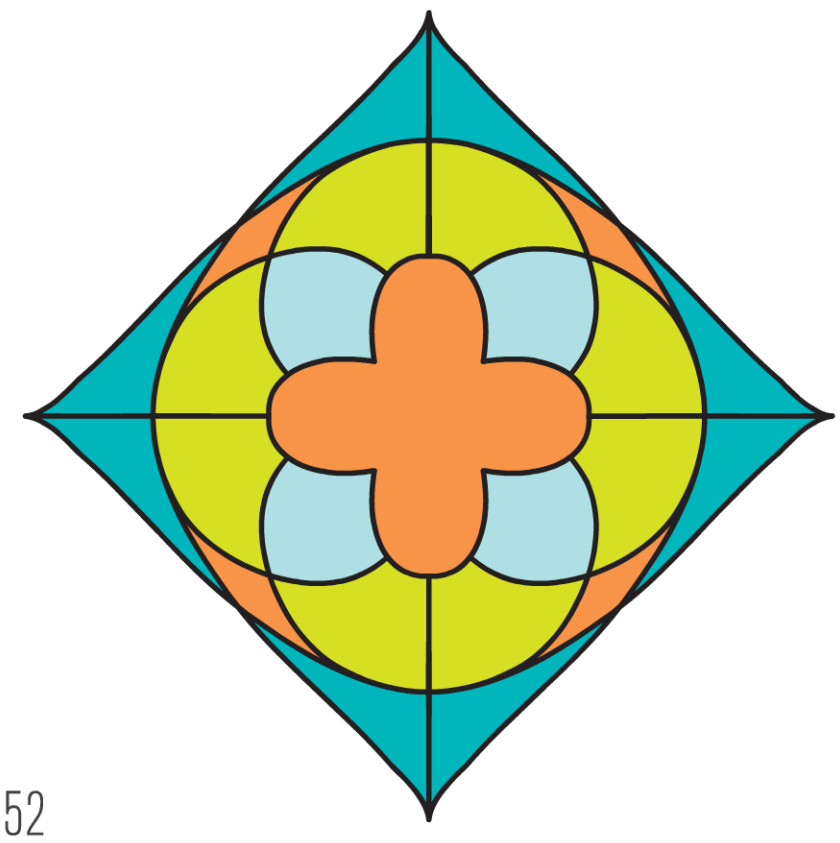

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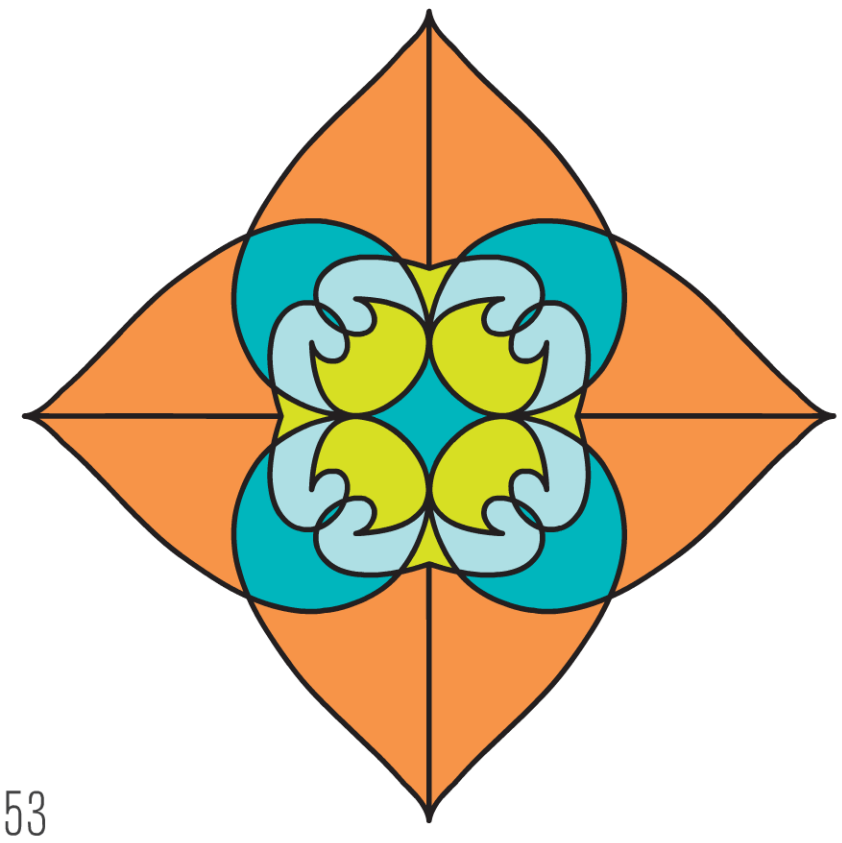

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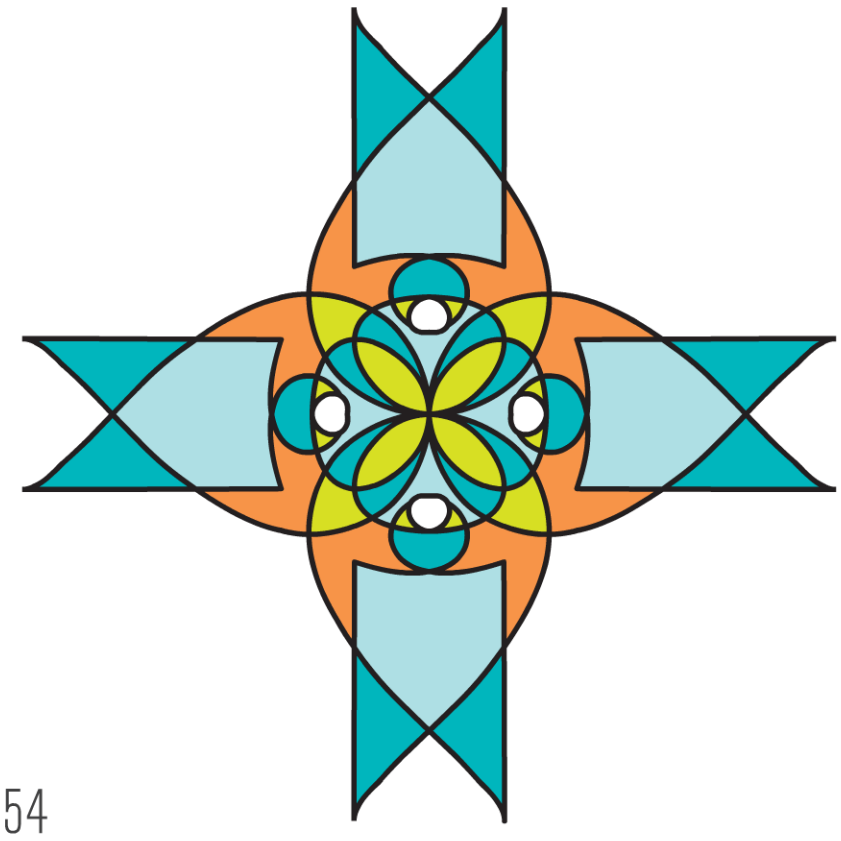

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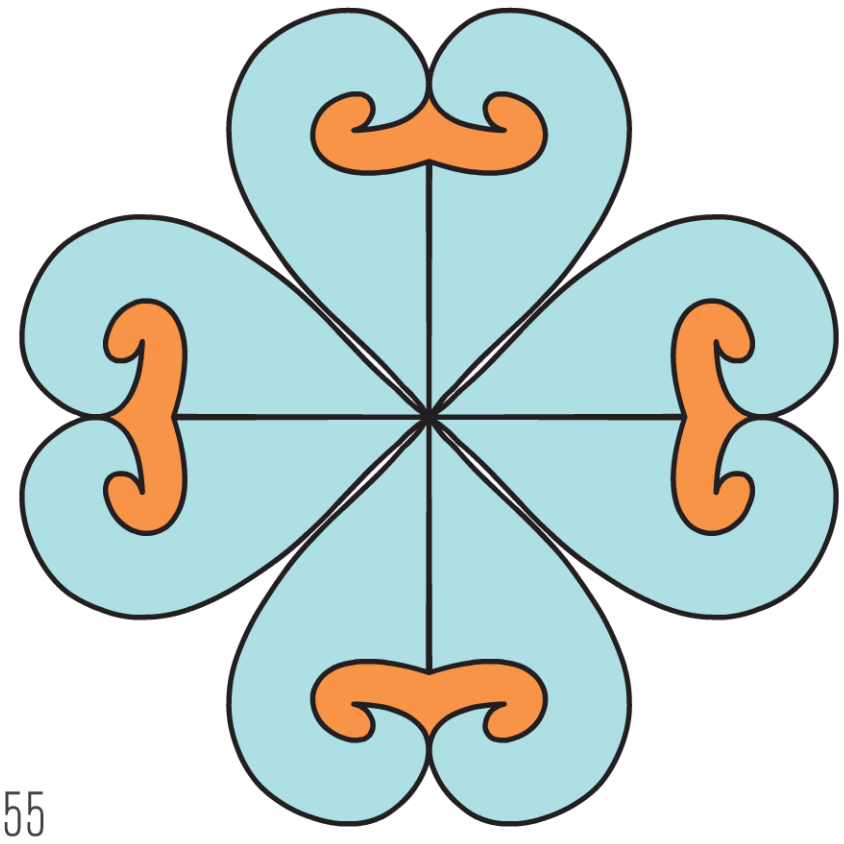

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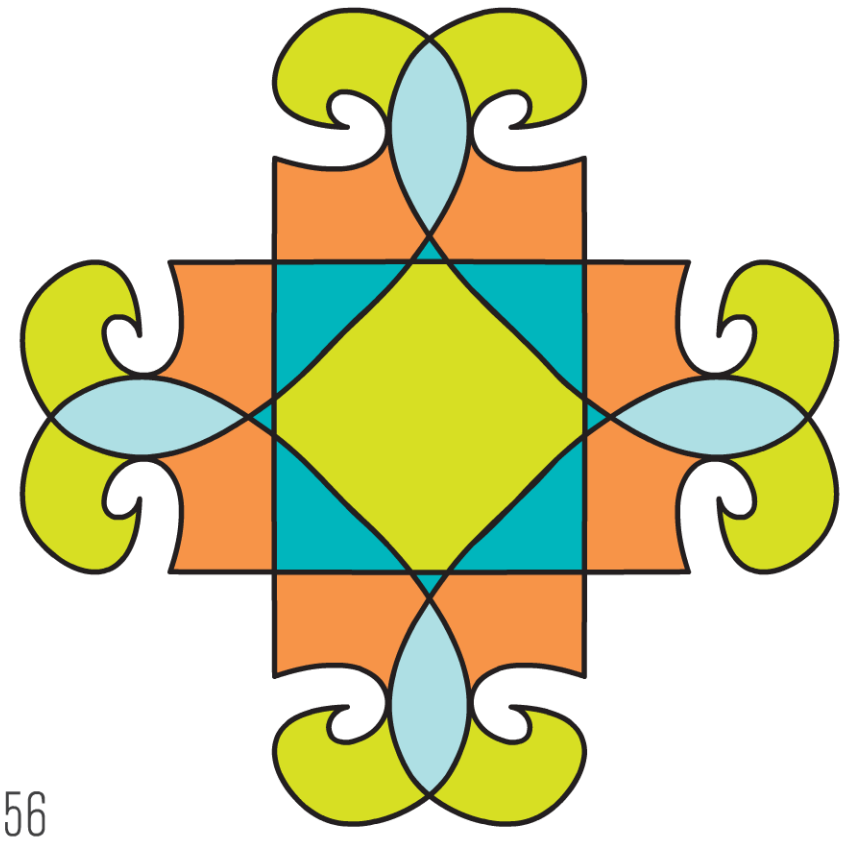

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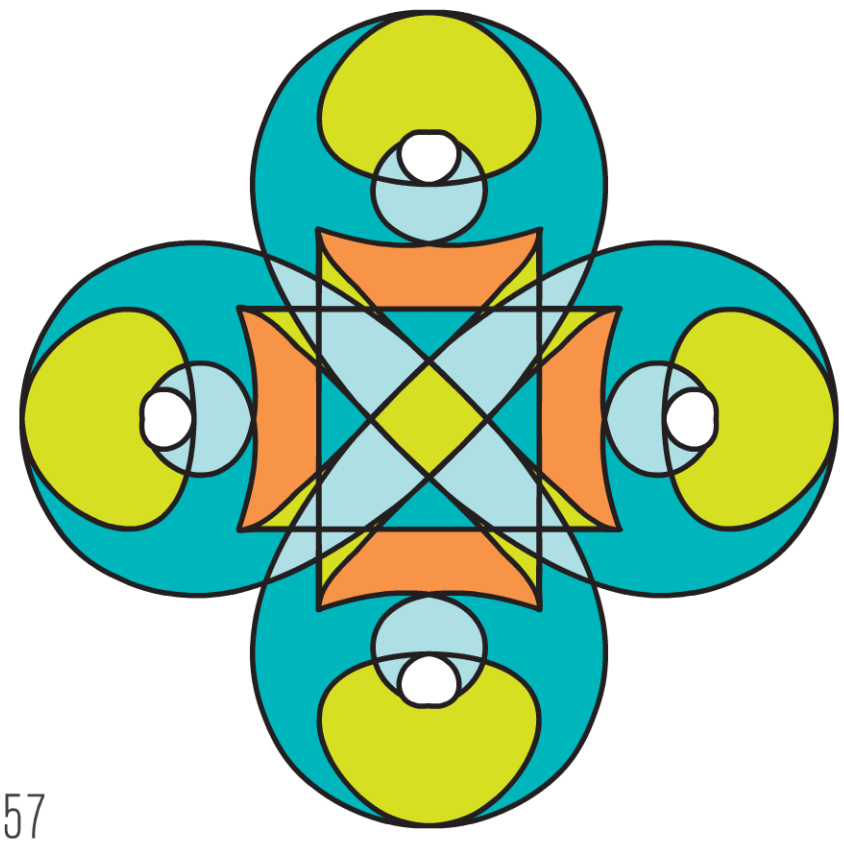

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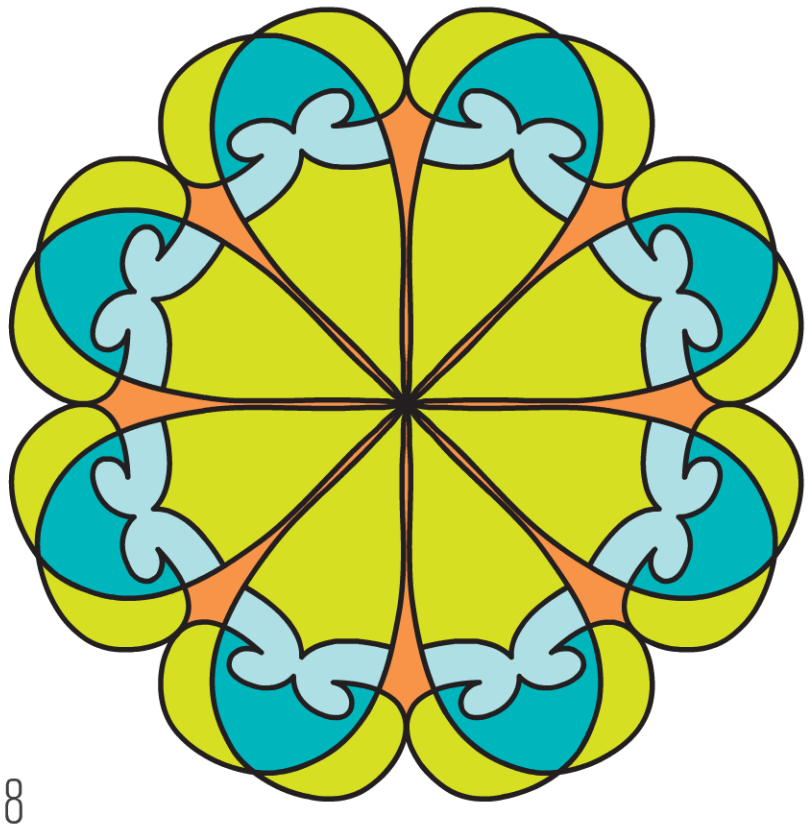

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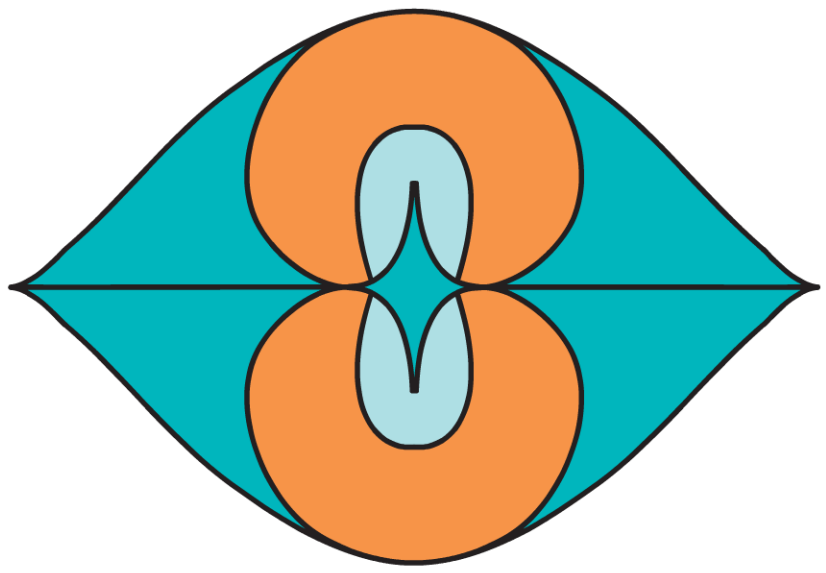

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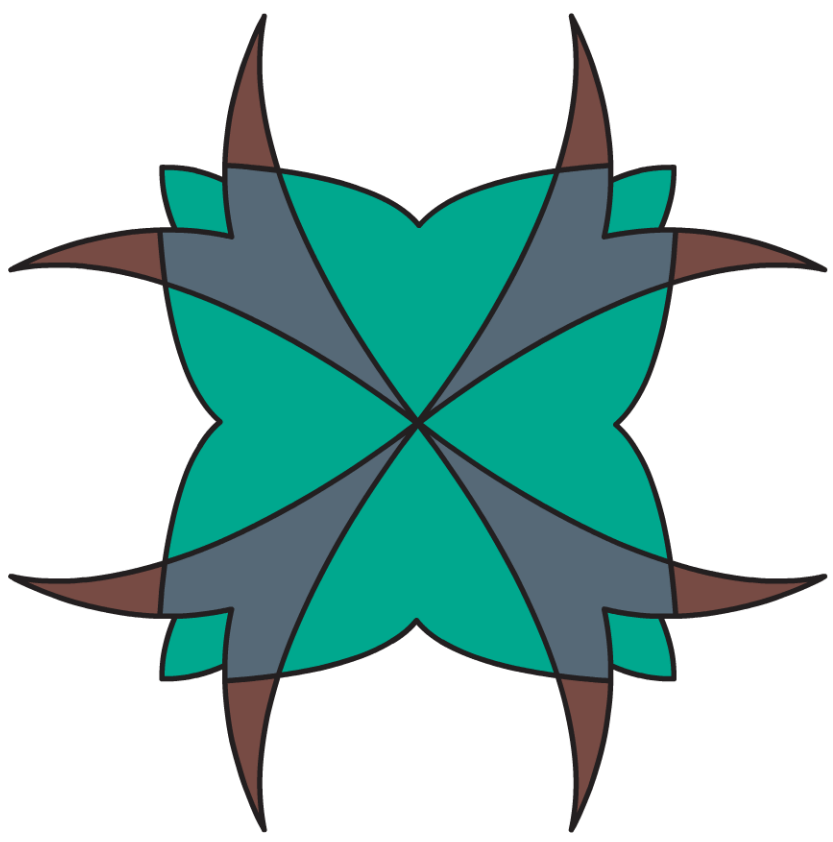

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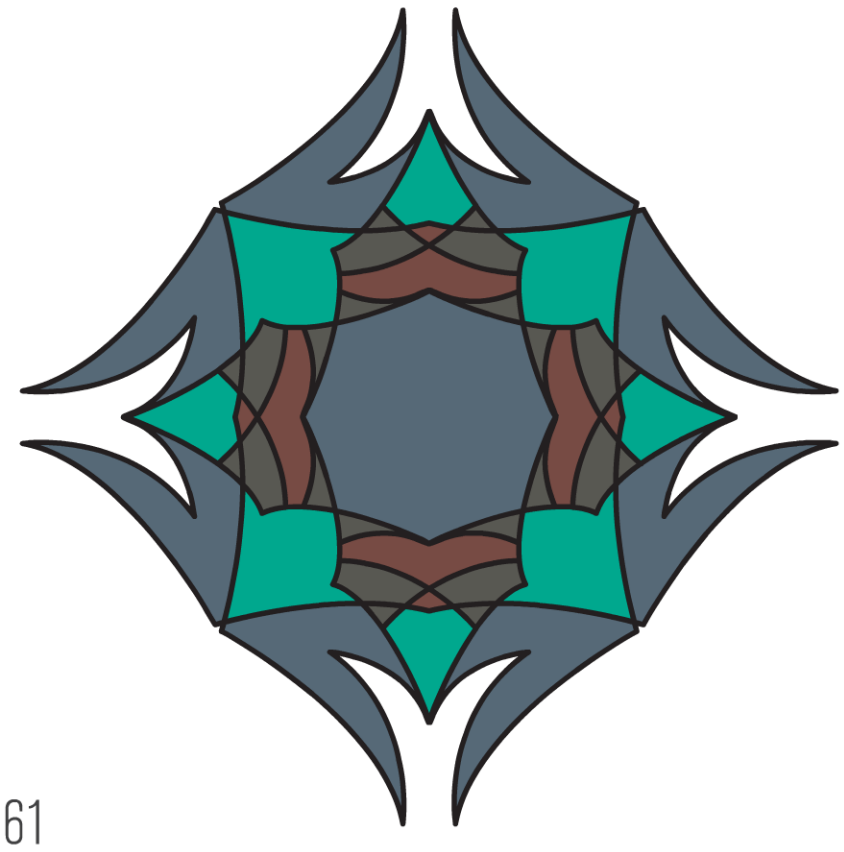

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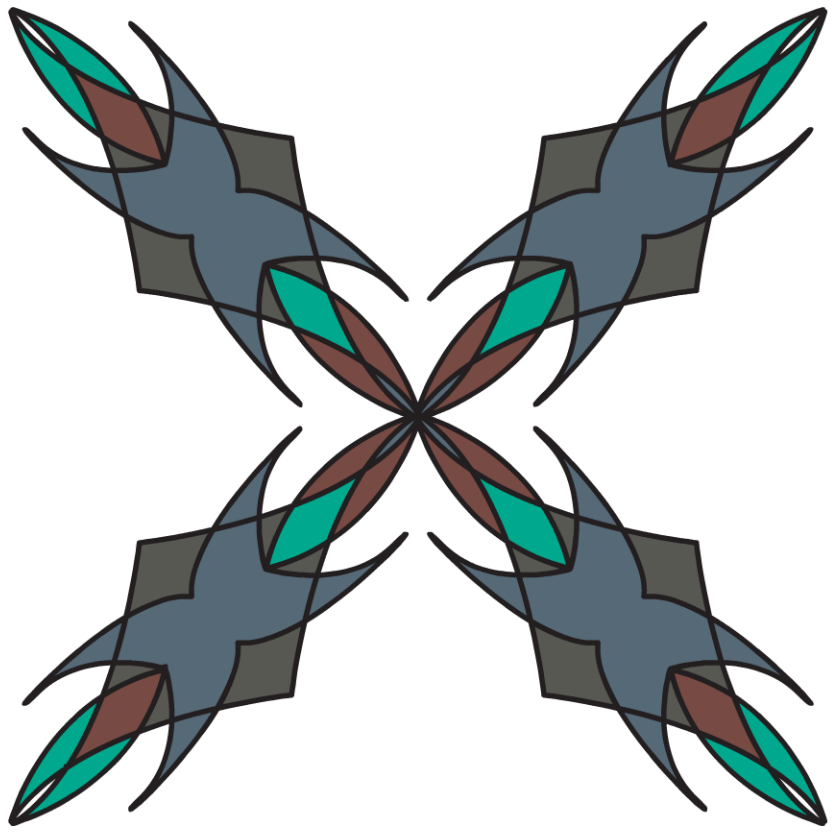

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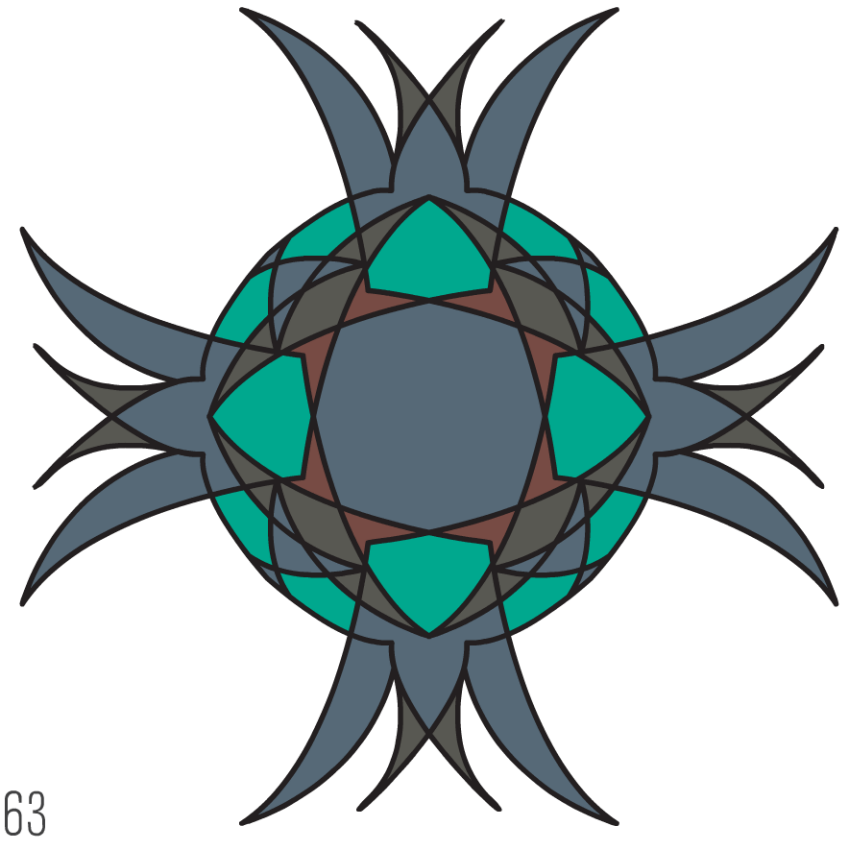

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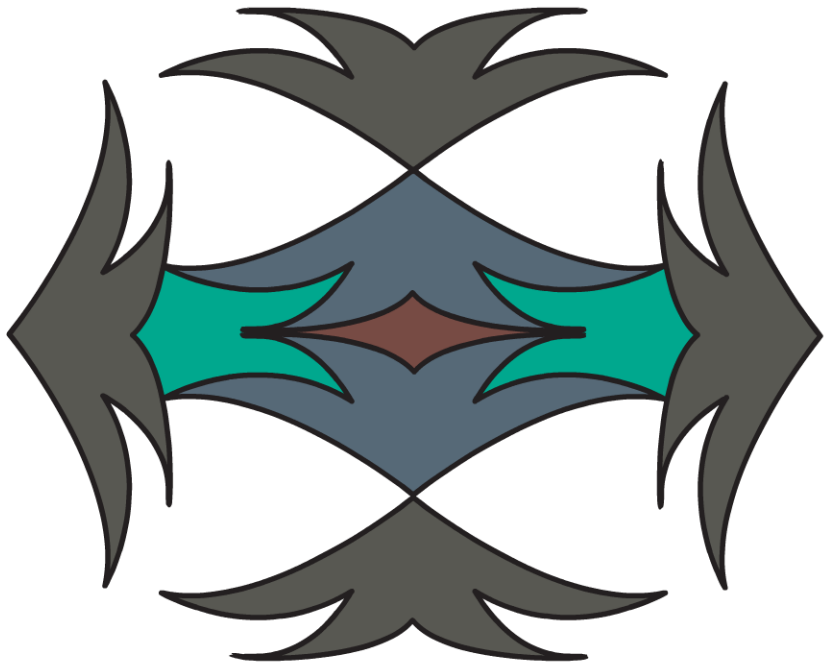

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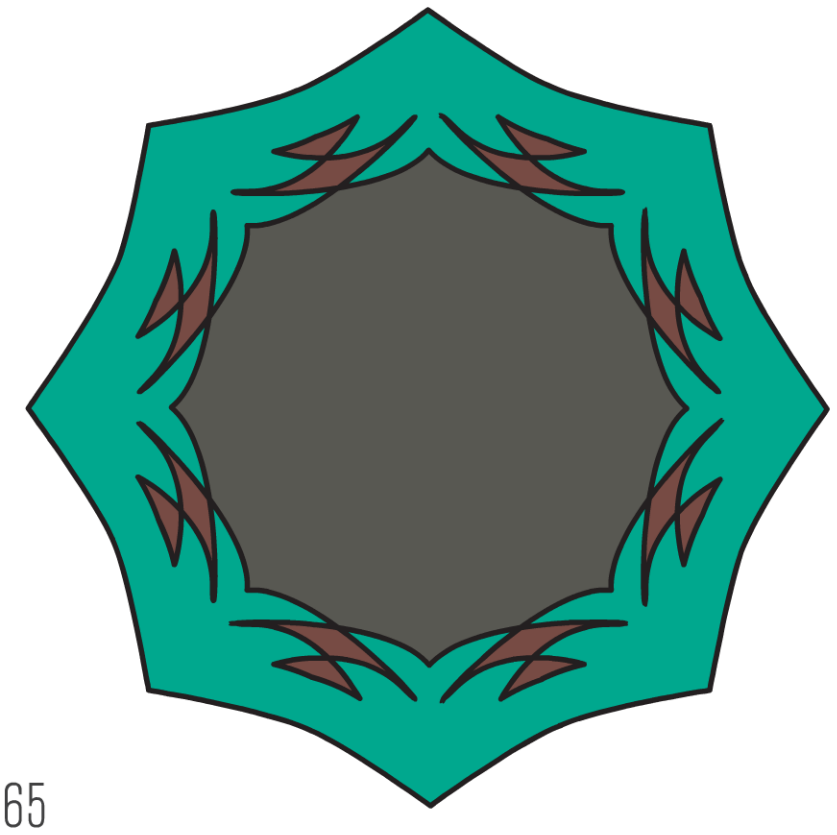

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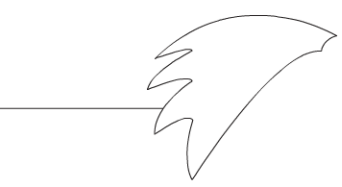

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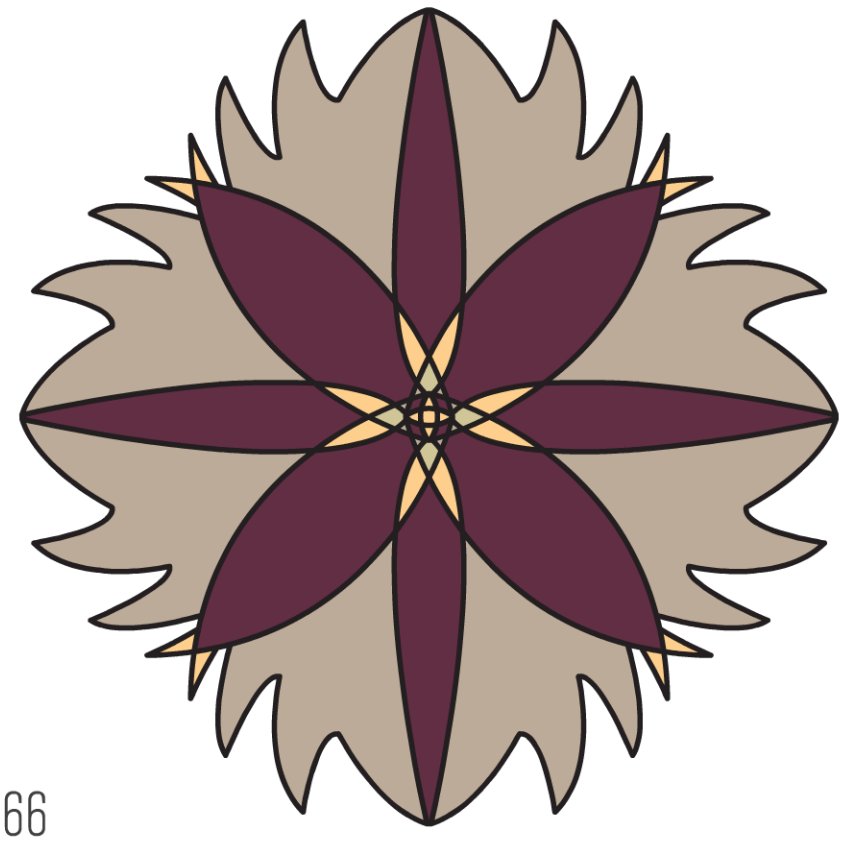

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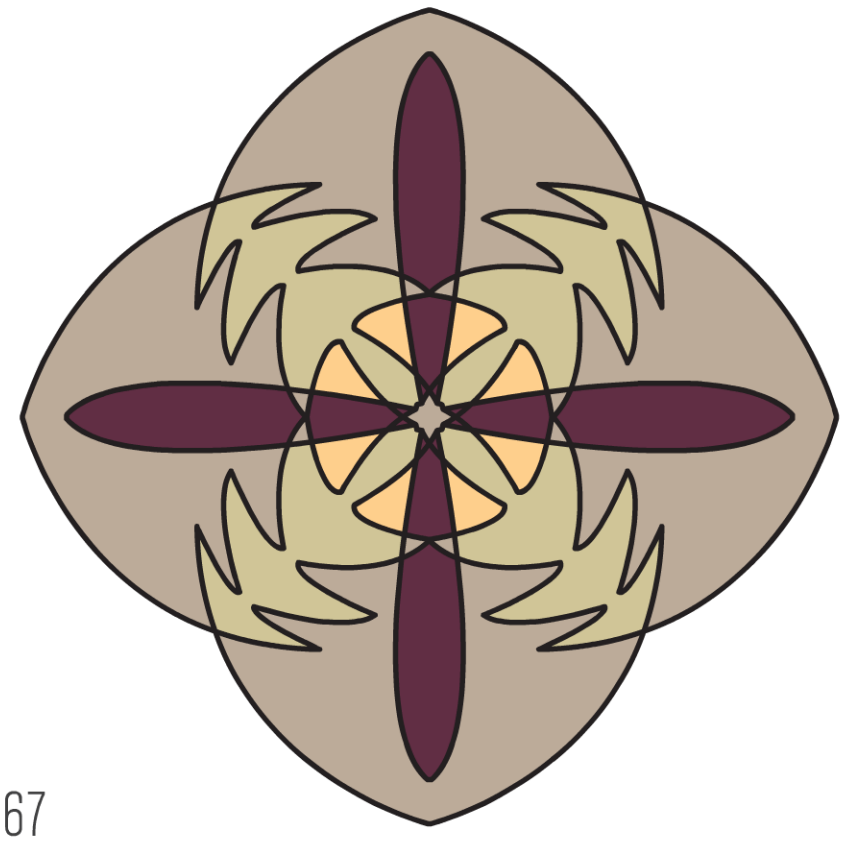

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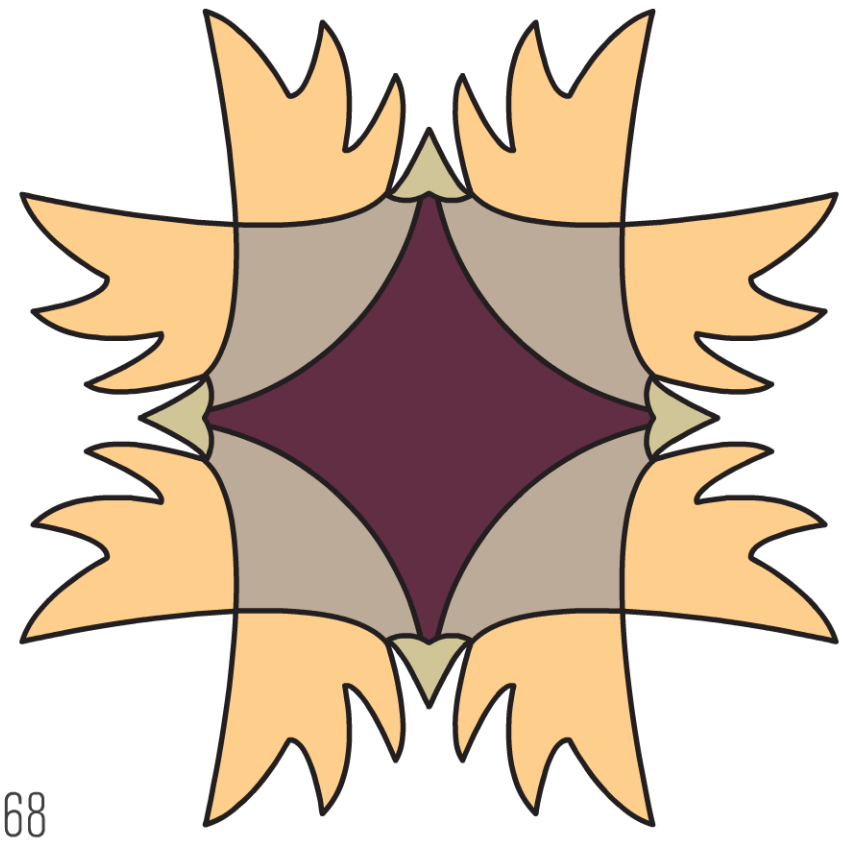

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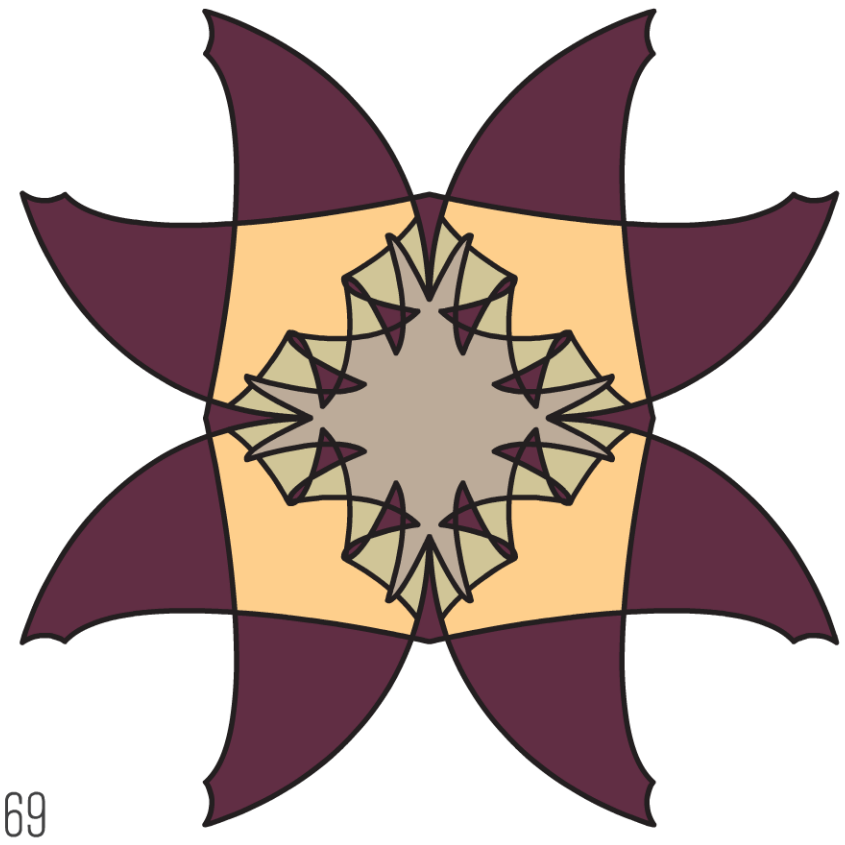

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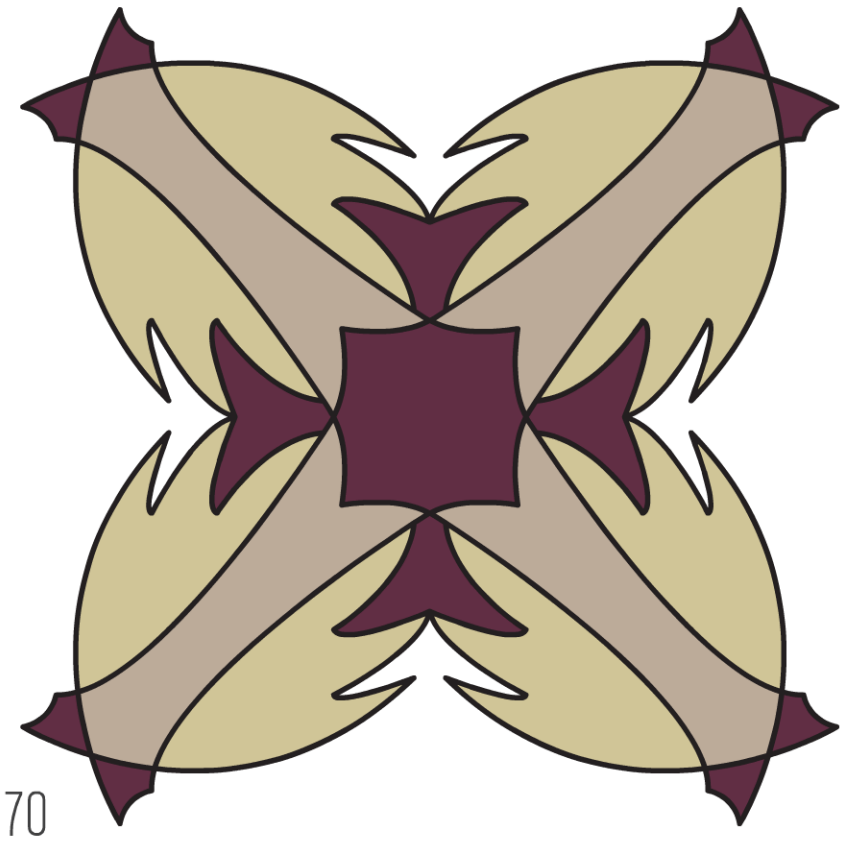

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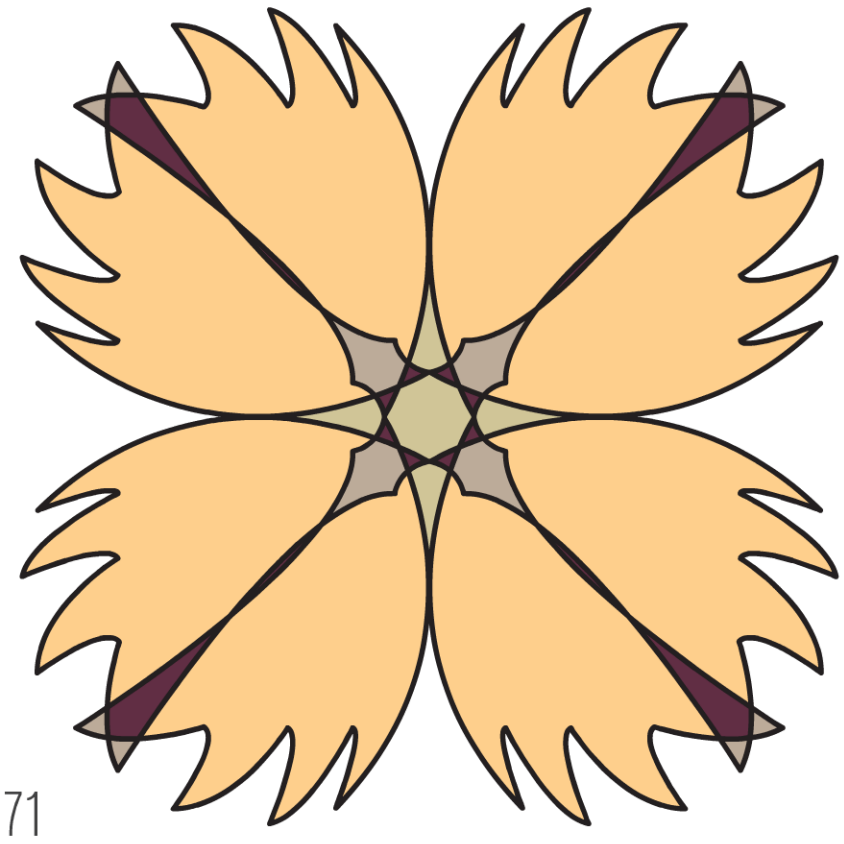

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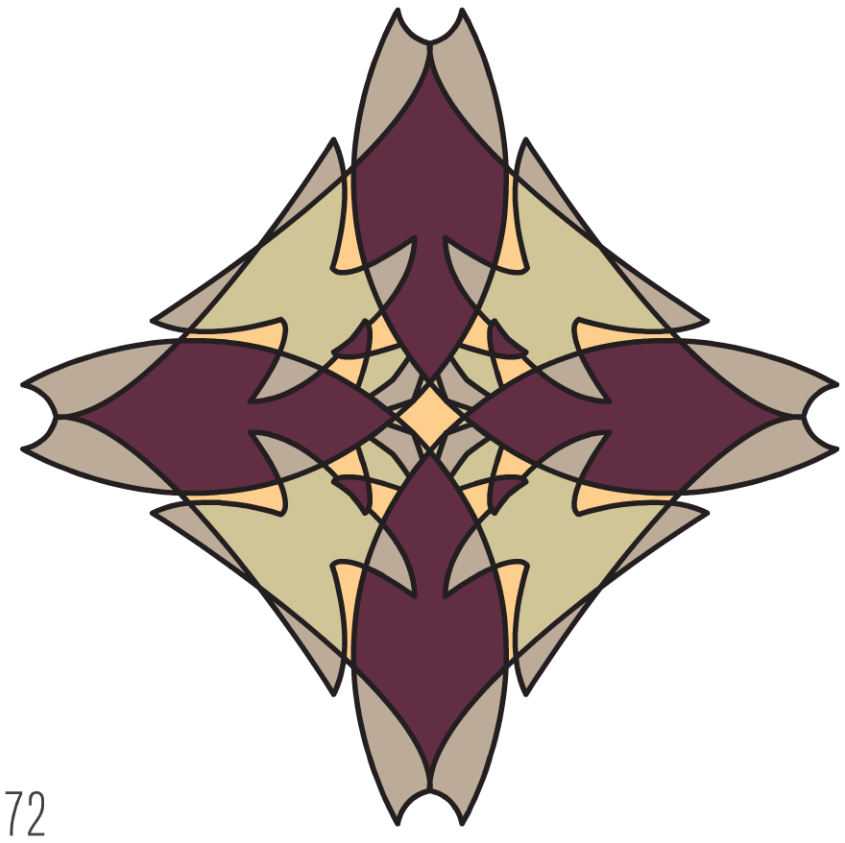

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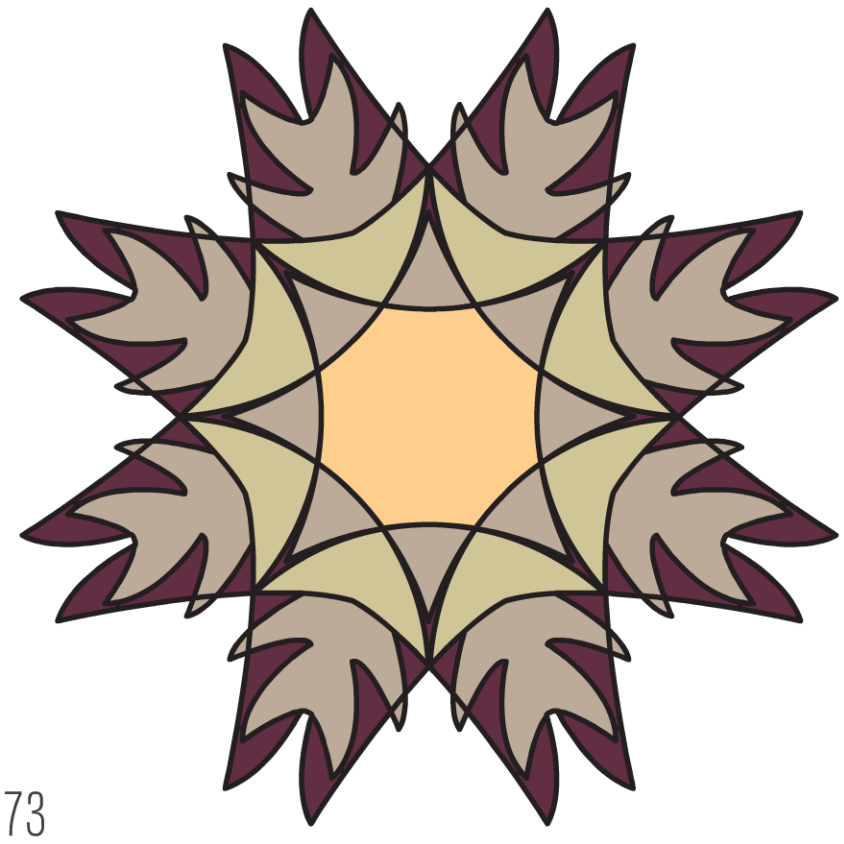

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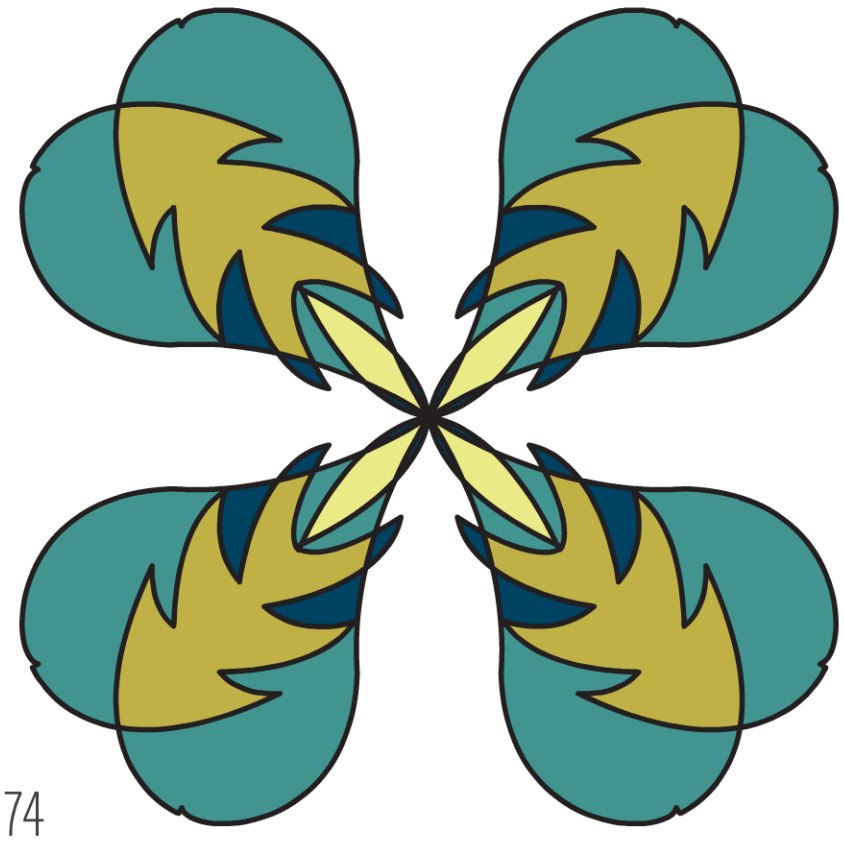

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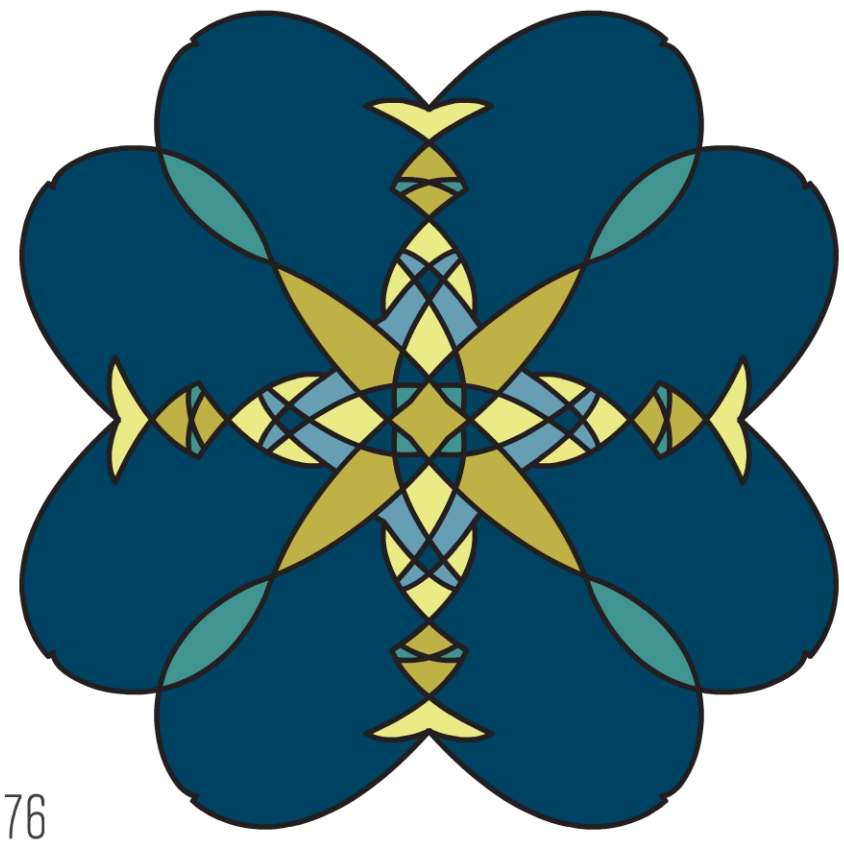

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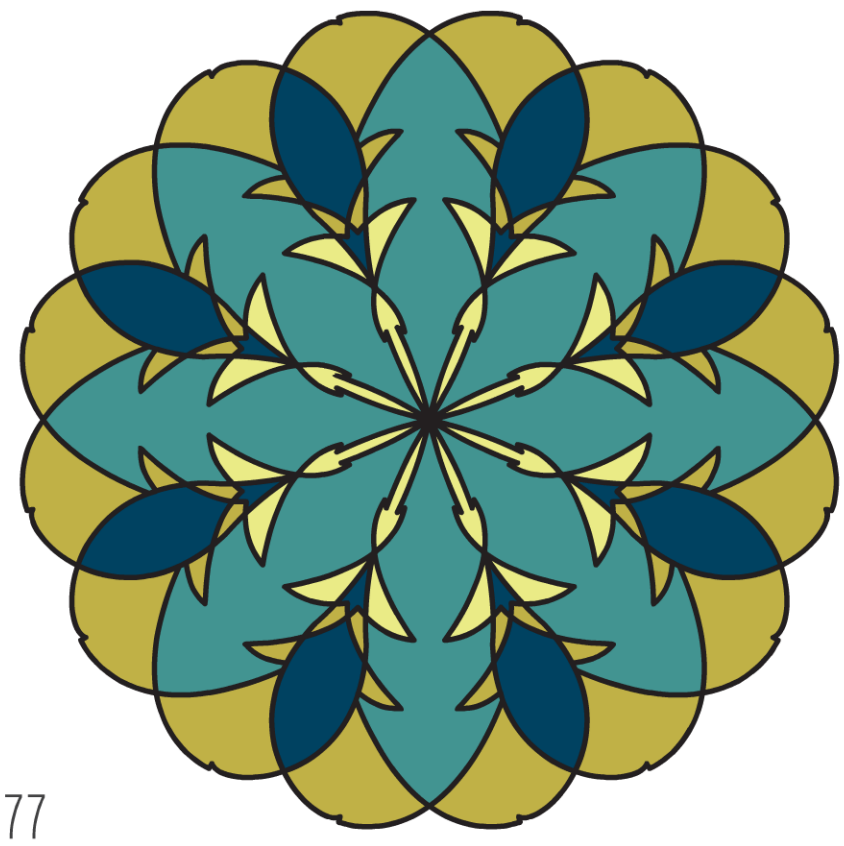

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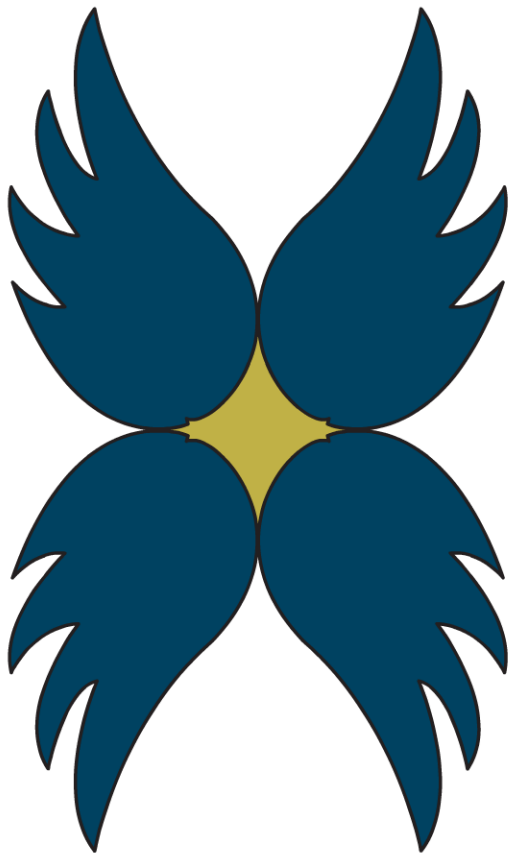

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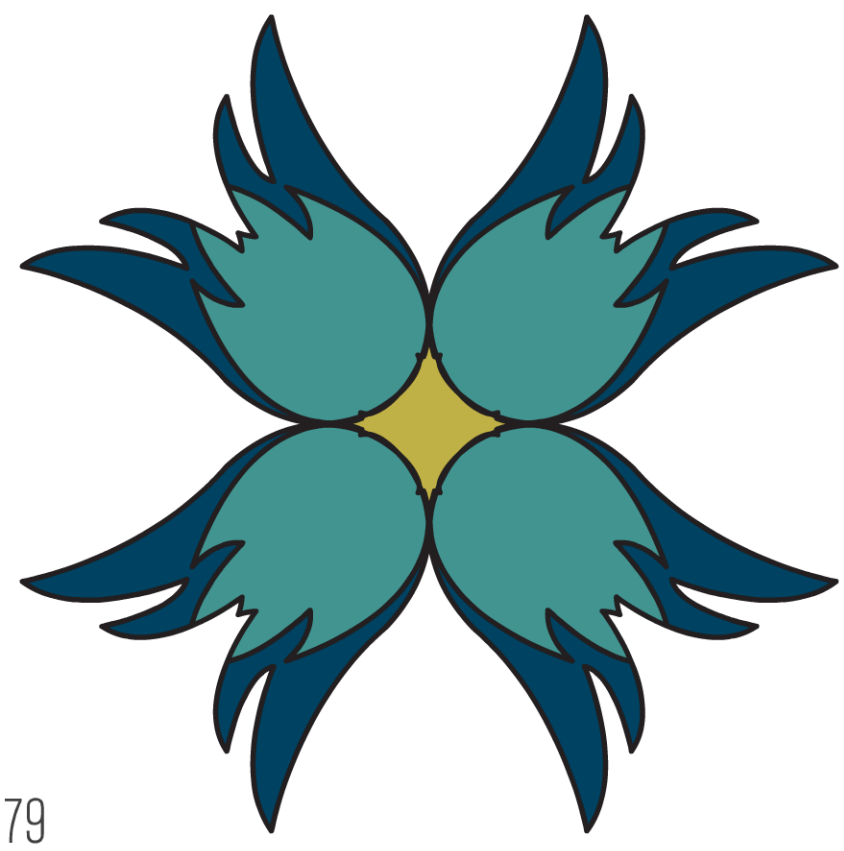

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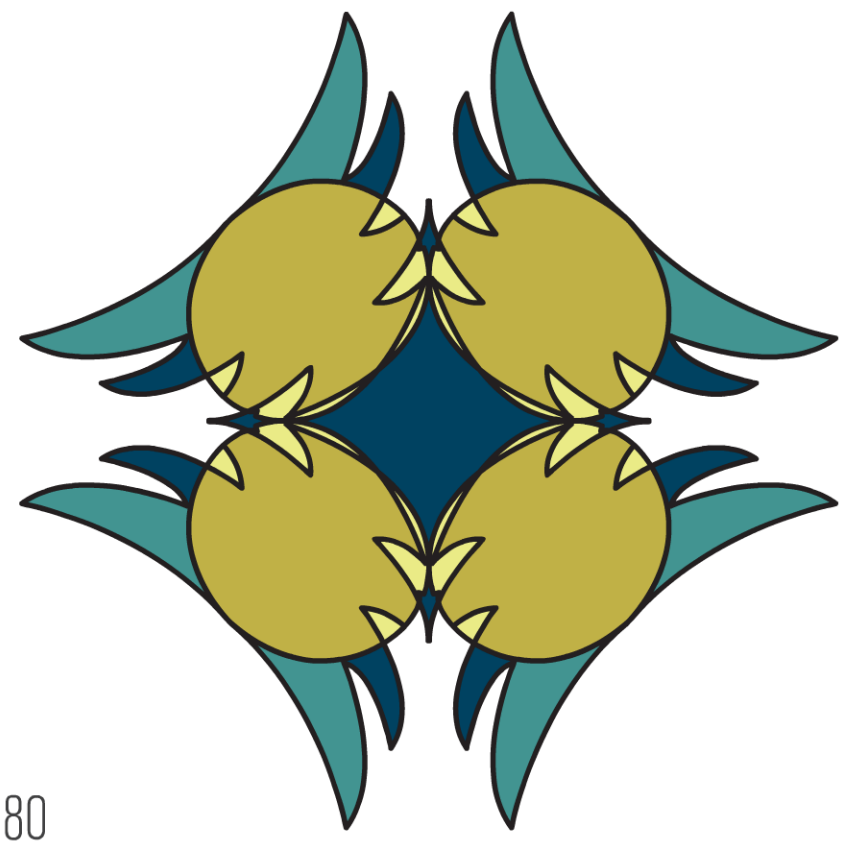

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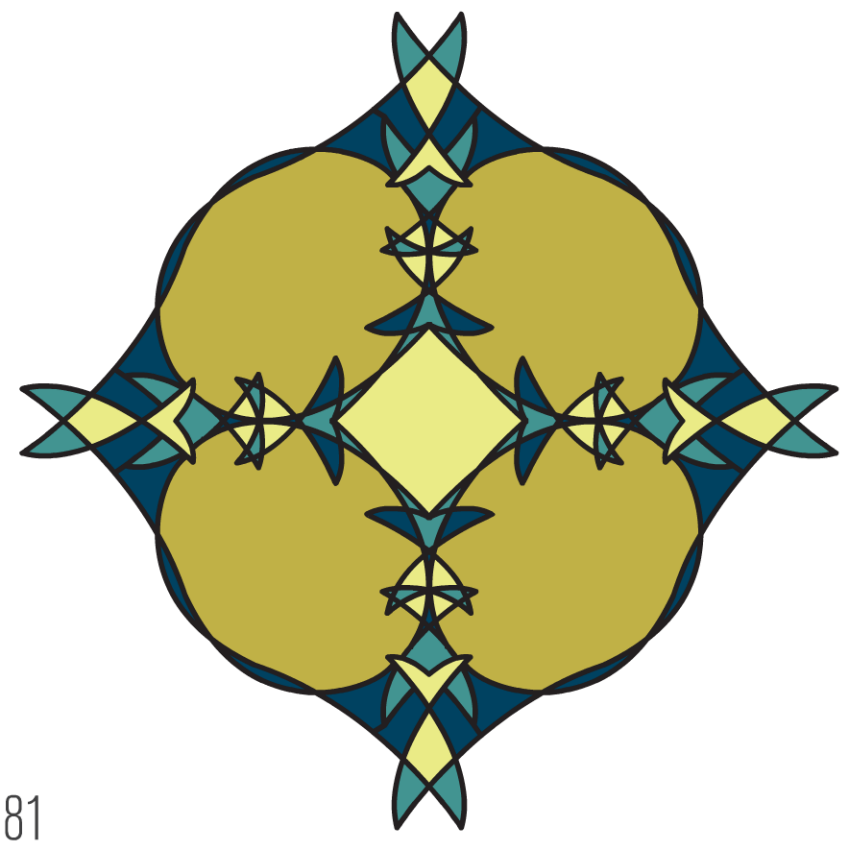

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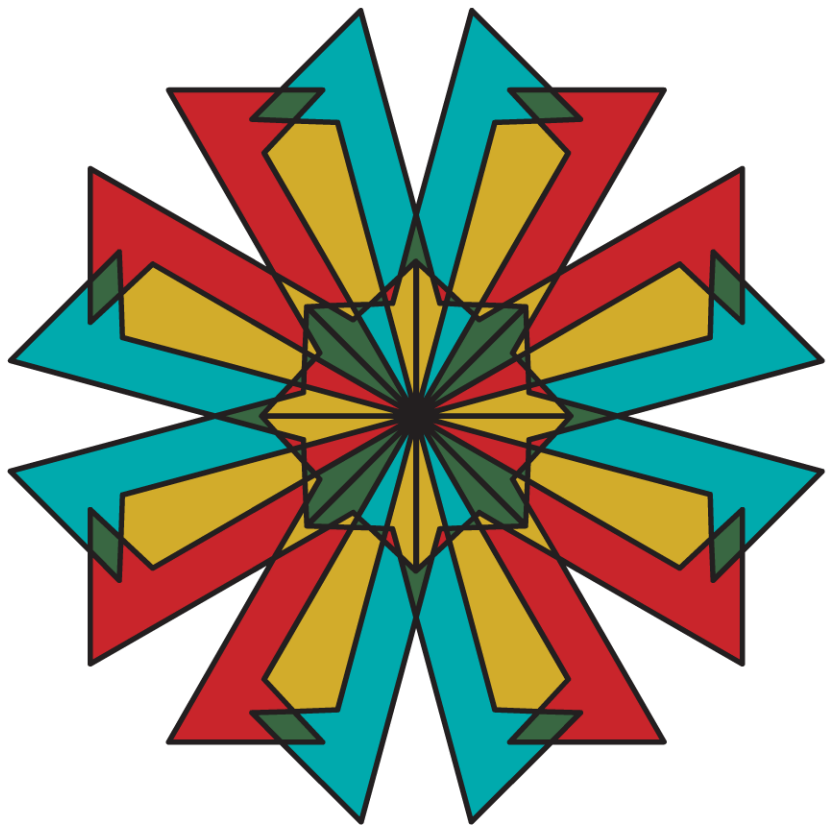

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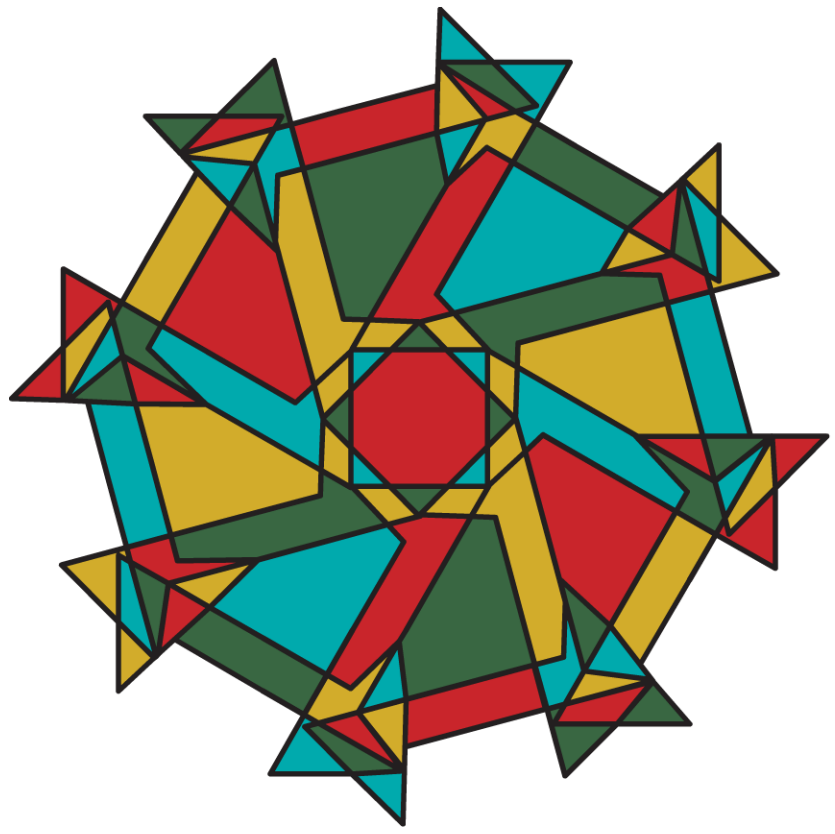

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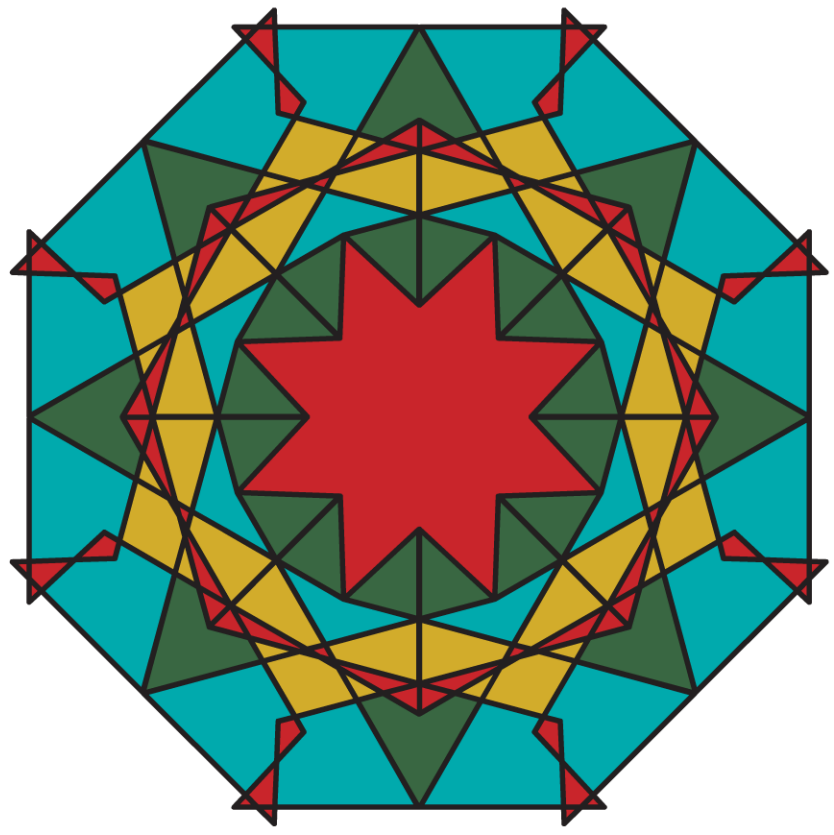

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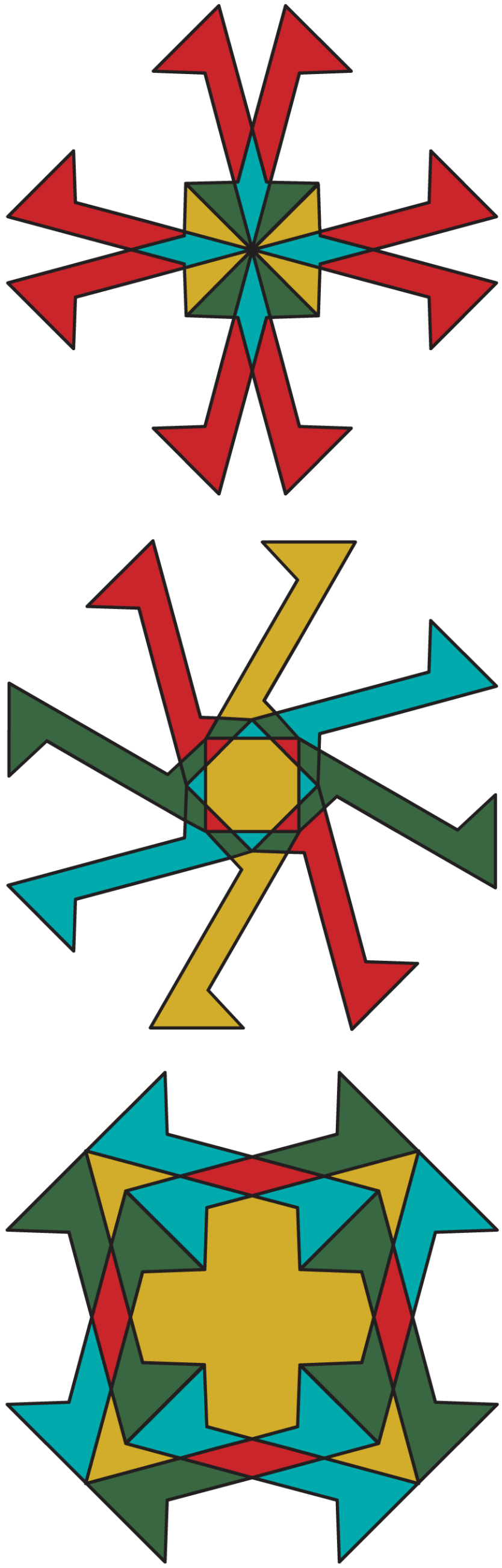

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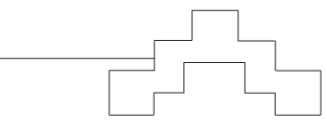

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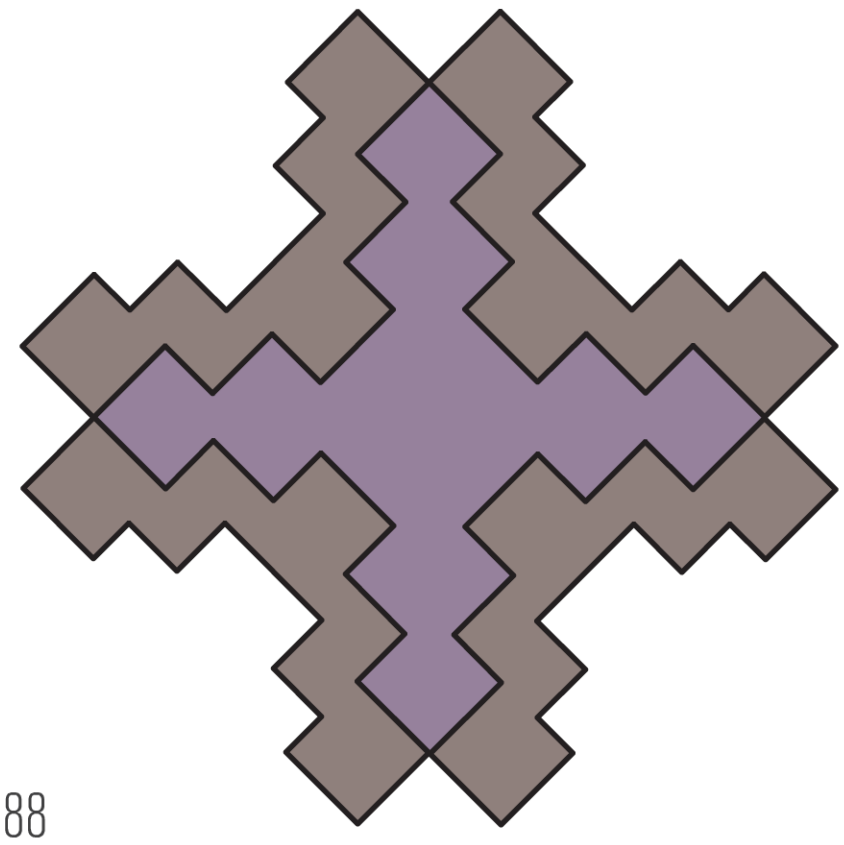

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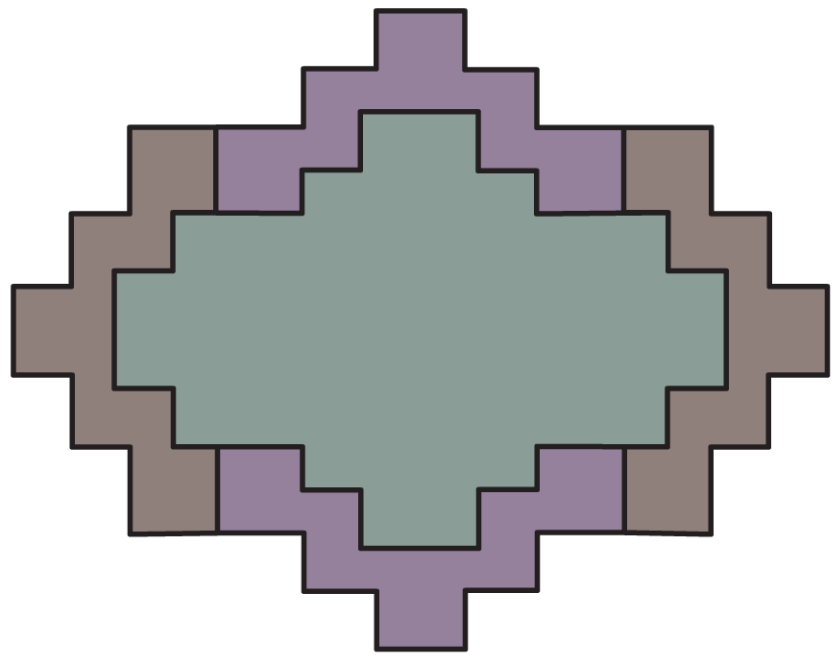

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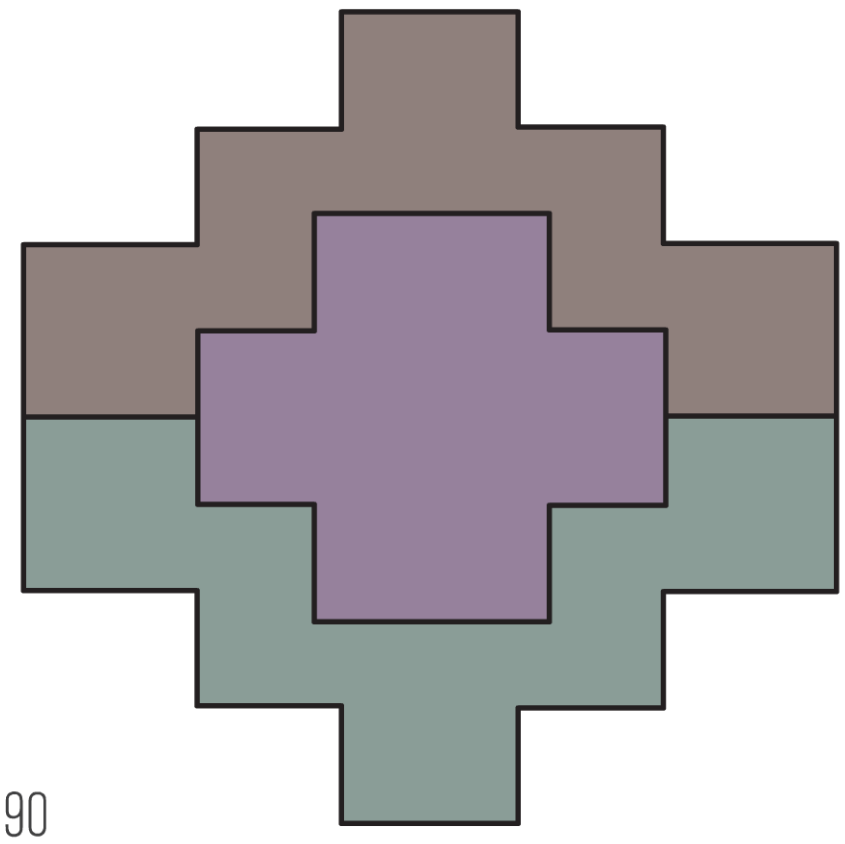

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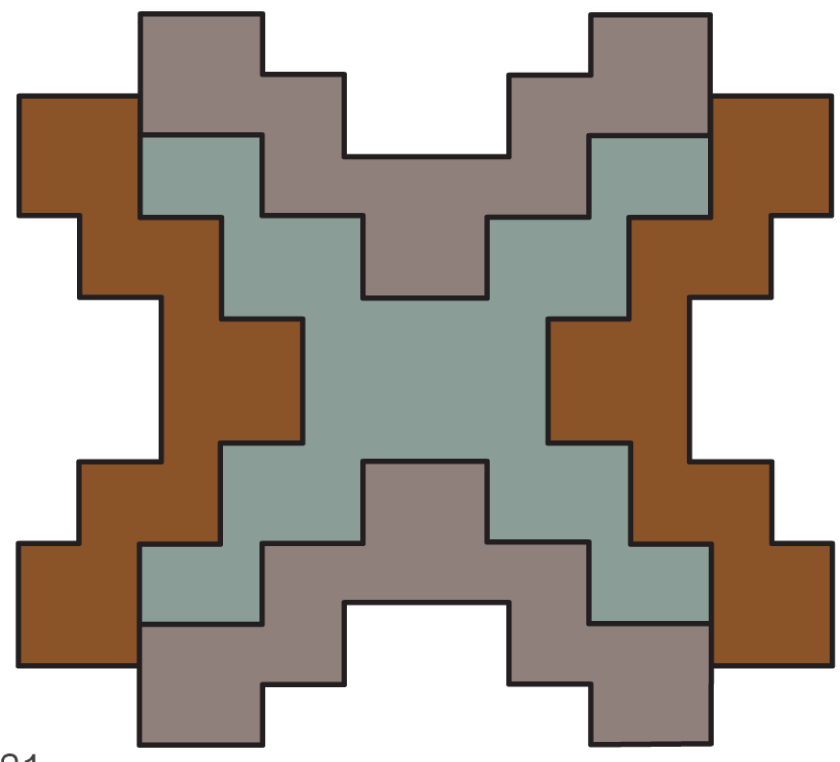

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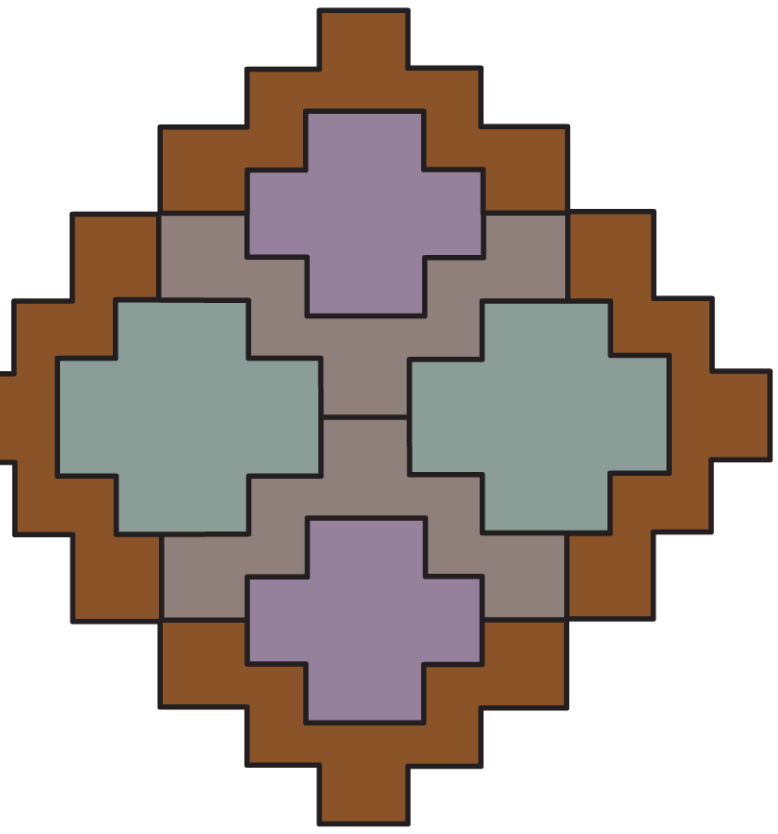

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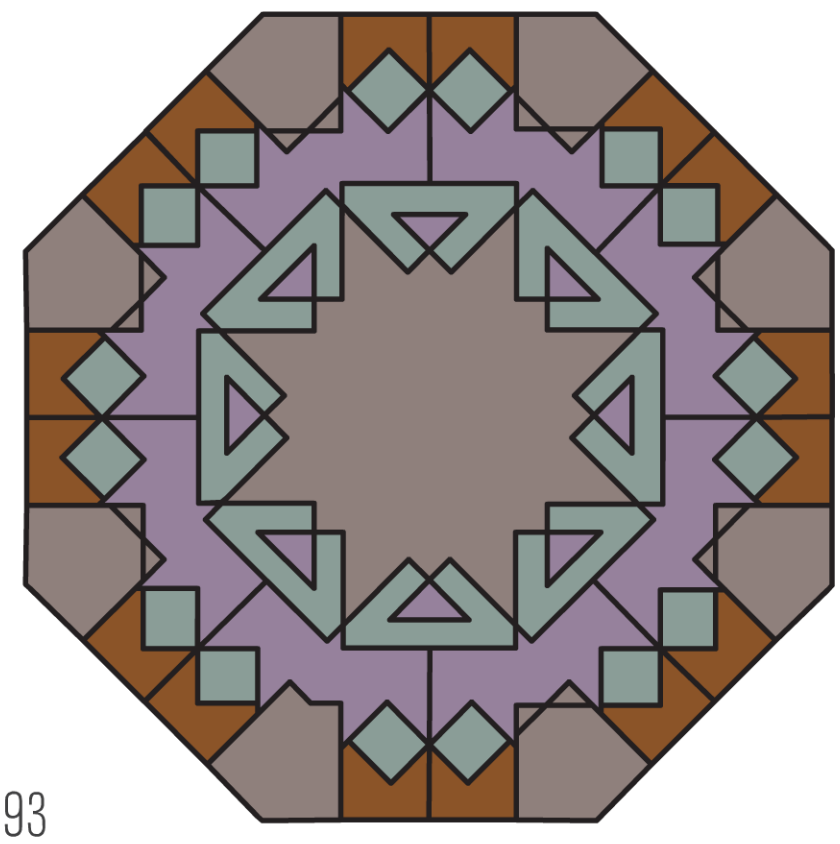

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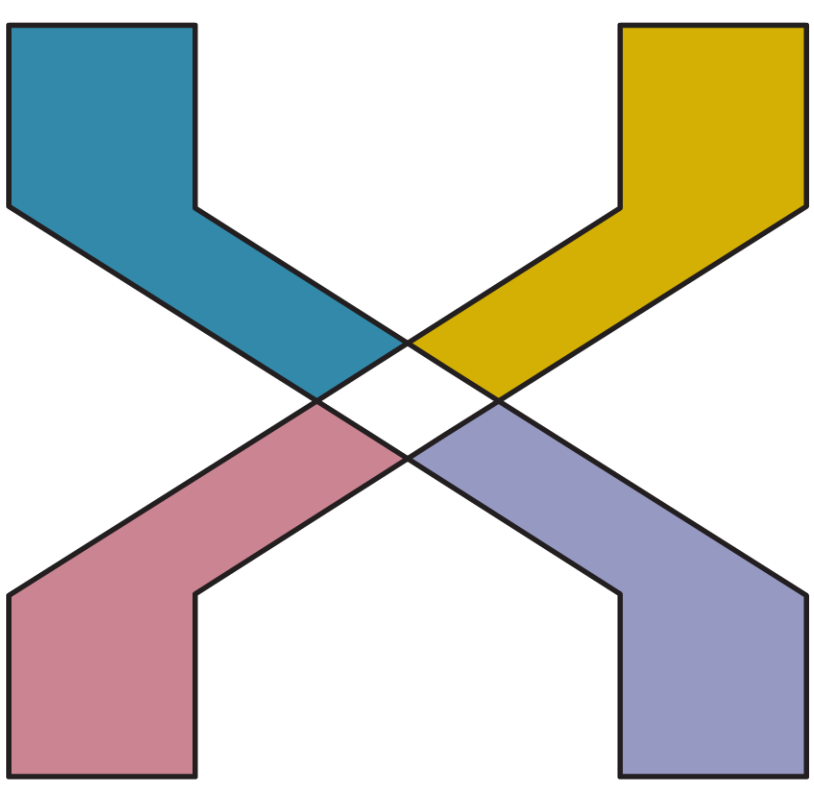

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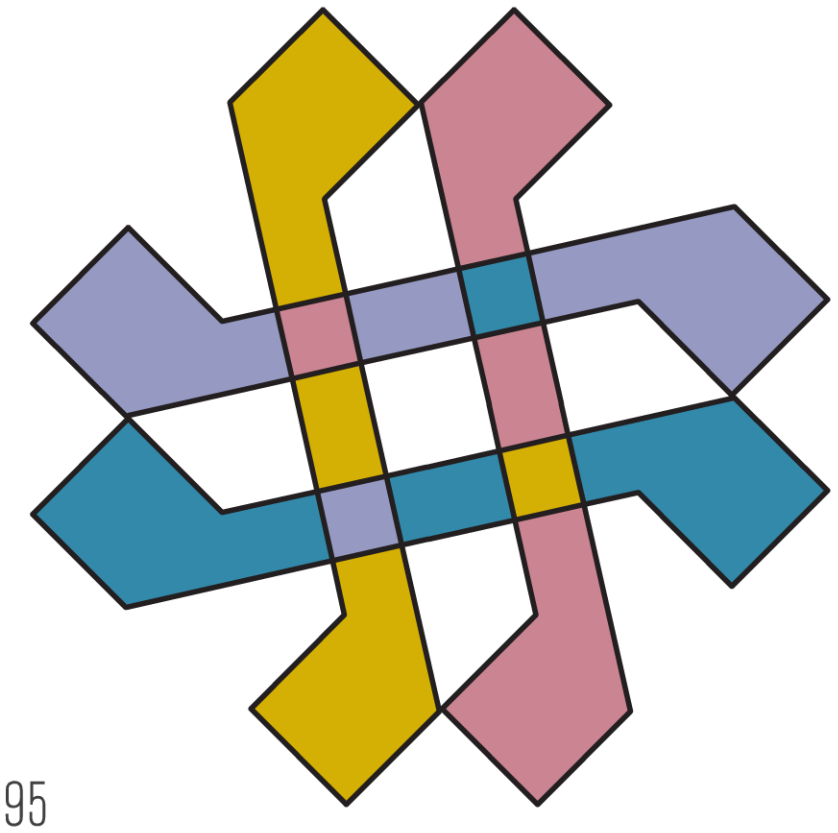

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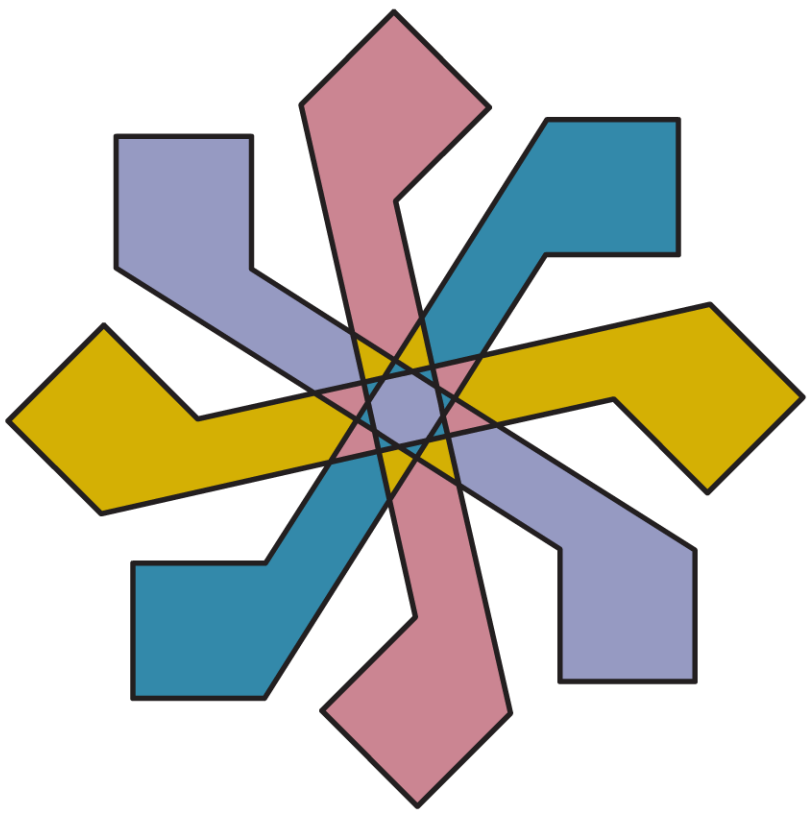

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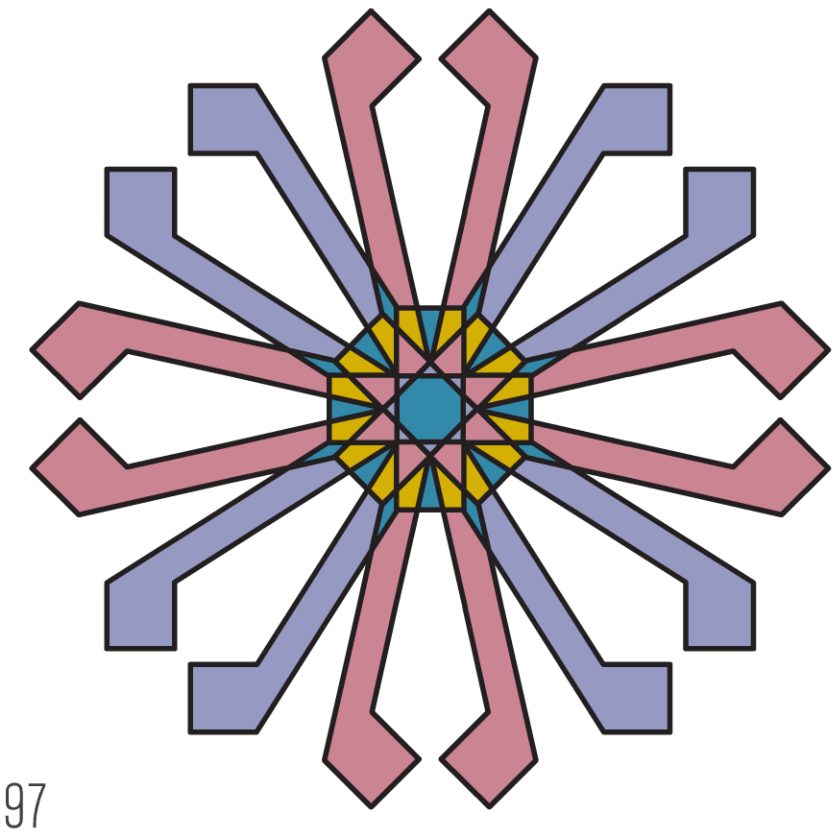

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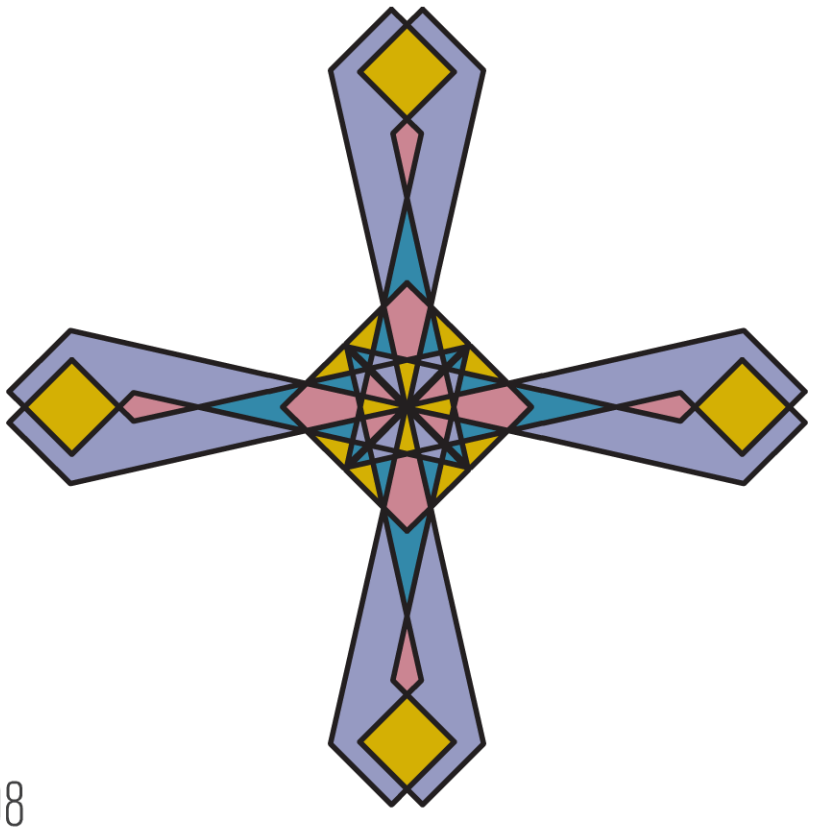

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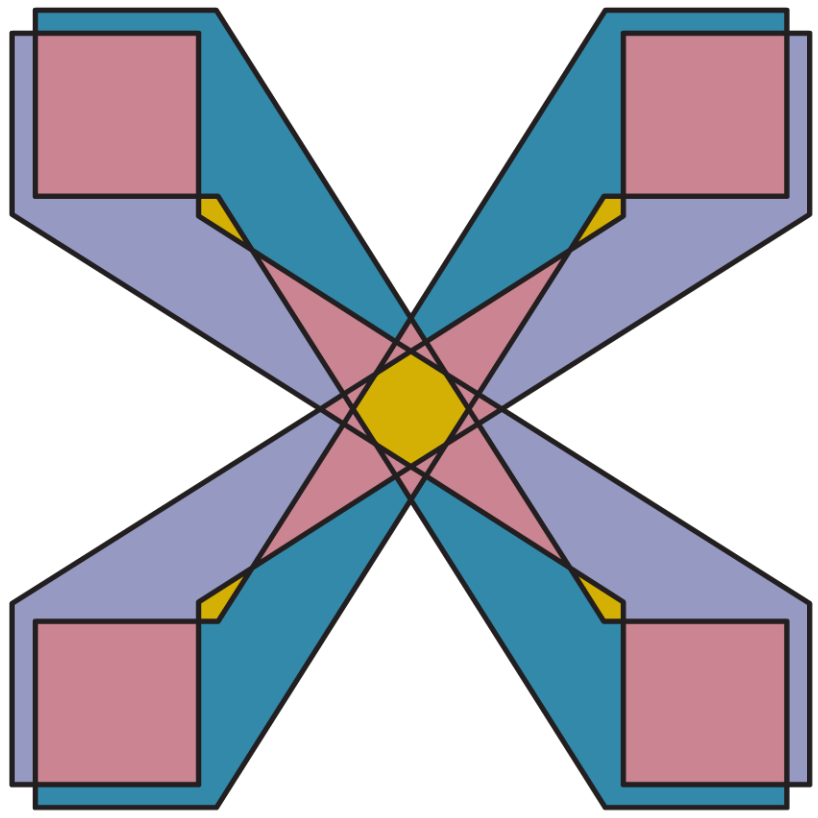

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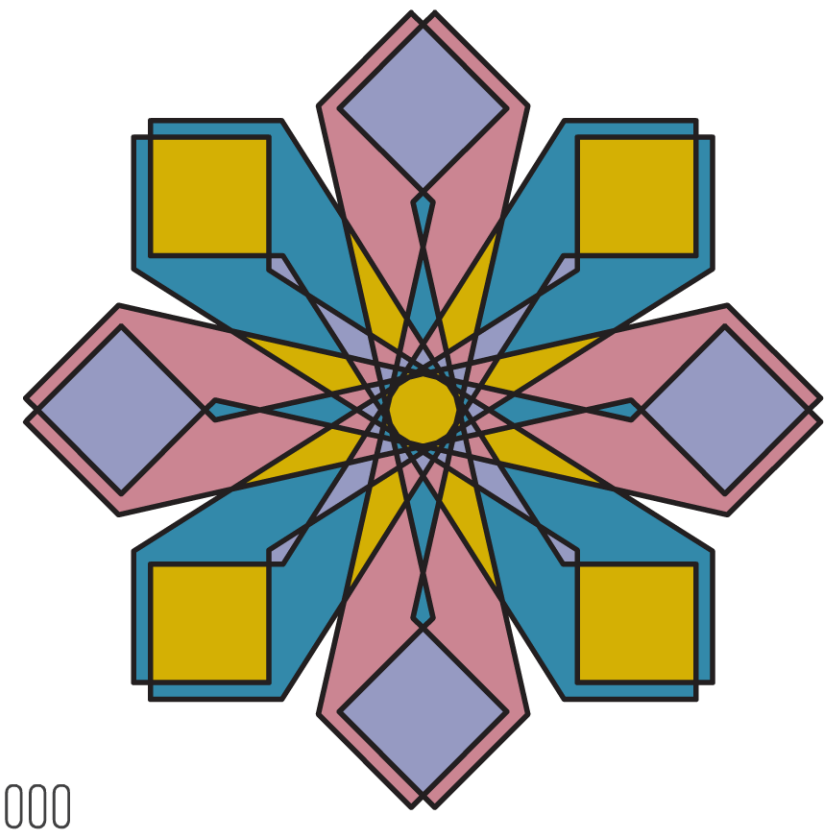

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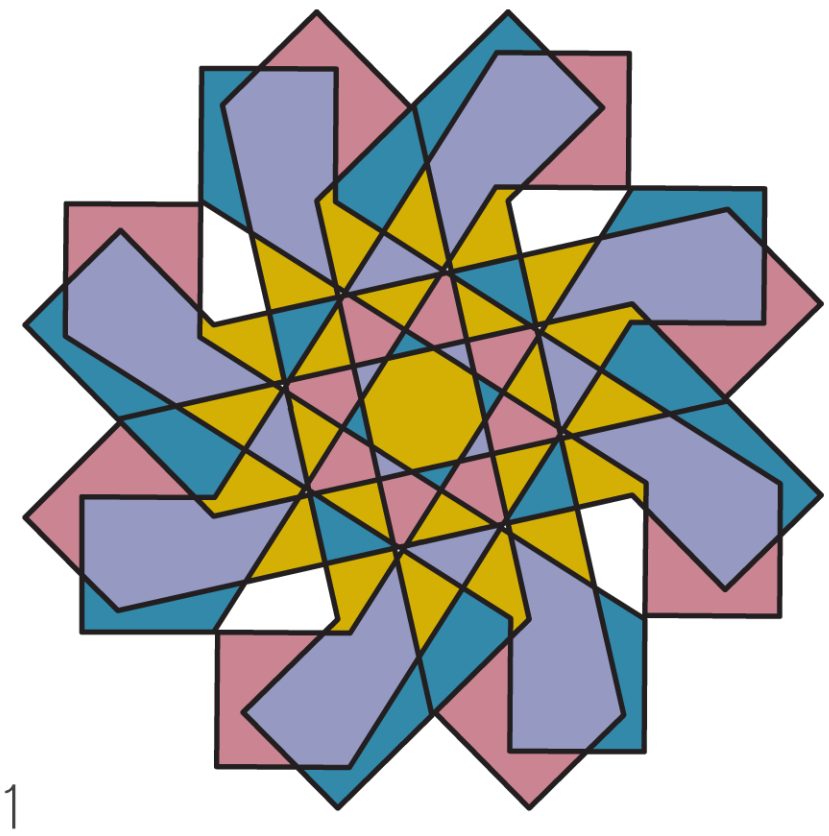

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Footnotes

1. Conway, J. H., Burgiel, H., & Goodman-Strauss, C. (2008). *The Symmetries of Things.* Wellesley, MA: A. K. Peters.
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About the Authors

Jay Friedenberg is professor of psychology and chair of the psychology department at Manhattan College. He founded and directs the Cognitive Science Program at the college, whose mission is to educate undergraduates in and prepare them for graduate study in the cognitive sciences and allied fields. He also currently serves as department chairperson.

Friedenberg's research interests are in vision and he has published numerous articles on symmetry detection, center of mass estimation, and art perception. In addition to focused publications in the above-mentioned areas, he has written a number of books on cross-disciplinary topics.

Jacob Roesch is an artist, designer, and educator whose work spans across many disciplines, from fine oil painting to children's book illustration. His work has appeared in numerous shows including *ORG: Reaping the White Walls* at the Macy Gallery, *Ground Zero* at the Detroit Museum of New Art, AGAST at the Gowanus Art Center, and *Selected Works* at the Carrie Haddad Gallery in Hudson, New York. Roesch currently teaches graphic design and digital drawing at Manhattan College and continues to hone his painting and design skills. He resides in Connecticut with wife, Diana, and his dog, Fergus.

Acknowledgments

We would like to thank those Manhattan College undergraduate research assistants who contributed their time and effort toward this project.